



# CBMS606

## Medicinal Chemistry

S1 Day 2019

*Dept of Molecular Sciences*

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#### Disclaimer

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## General Information

Unit convenor and teaching staff

Unit Convenor, lecturer and lab demonstrator

Peter Karuso

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Contact via 8290

F7B232 (4WW 232)

anytime but call or e-mail first

lecturer, lab demonstrator and co-convenor

Joanne Jamie

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F7B231 (4WW 231)

Have an open door policy, but students are encouraged to arrange a meeting via email.

Lecturer

Andrew Piggott

[andrew.piggott@mq.edu.au](mailto:andrew.piggott@mq.edu.au)

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F7B334 (4WW 334)

Have an open door policy, but students are encouraged to arrange a meeting via email.

Joanne Jamie

[joanne.jamie@mq.edu.au](mailto:joanne.jamie@mq.edu.au)

Credit points

4

Prerequisites

(Admission to MBiotech or MBioBus or MLabQAMgt or MRadiopharmSc or MSc or MSInnovation) and permission by special approval

Corequisites

Co-badged status

co-badged with CBMS306

### Unit description

Medicinal chemistry is the application of chemistry to the discovery, design and synthesis of new drugs. This unit is of value to all molecular sciences and medical sciences students. The central core of the unit is the description of methods used for the discovery of new drugs, how these are modified to produce more active compounds, transportation to and from their points of action and how they are cleared from the body. Topics include: the structure and function of biological targets (proteins and DNA); sources of new drugs from nature; and lead generation and methods of lead modification to make more active, selective or less toxic drugs. This is followed by a study of structure-activity relationship methods; pharmacokinetics, drug metabolism and prodrugs, and chemical genetics. Case studies are also provided, including antibacterial and anticancer agents, and nucleic acid therapies. The theory is complemented by a discovery-based laboratory project incorporating synthetic chemistry, spectroscopic methods, bioassays and computational chemistry to elucidate the essential structural features necessary for the sulfonamide class of antibacterial agents.

## 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:

By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure-activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.

By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.

By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental results to solve related problems.

By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.

By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## General Assessment Information

Your marks (in-class and online quizzes, mid-term exam, laboratory, oral presentation and final exam) will be placed on the CBMS606 web site.

Your final grade will be based on the mark from the aggregation of the individual assessments, **with 50% or greater needed overall for a pass.**

**Medical certificates or official documents must be lodged as part of a disruption to studies request at [ask.mq.edu.au](http://ask.mq.edu.au) as soon as possible if you are absent for any of the assessment tasks or miss the due date for any of the on-line tasks.** If your reason is regarded as valid for missing the in-class quizzes, you will be given an average of the other quizzes done; with the on-line quizzes an extension of time will be provided if the disruption to studies request is approved. If you miss the oral presentation, you will need to organise an alternative time with the unit convenor asap. If you miss the mid-session test or final exam for a valid reason, a supplementary test/exam will be provided. An extension for submission of the lab reports/lab books will also be provided if the disruption to studies approval is obtained. Any assessment tasks not submitted on time that does not get approval through the disruption to studies request will get a 10% deduction of marks for every weekday late.

**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.

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](http://ask.mq.edu.au).

**NOTE:** If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam

information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Provisional Patent Application</u>	25%	No	Mar 1, Apr 12, May 21, Jun 11
<u>Spectroscopy Training</u>	0%	No	April 8
<u>Mid-semester test</u>	15%	No	May 7
<u>Quizzes</u>	5%	No	in lectures and online
<u>Pharmaceutical Agent Report</u>	5%	No	April 30
<u>Final exam</u>	50%	No	week 15 (to be confirmed)

### Provisional Patent Application

Due: **Mar 1, Apr 12, May 21, Jun 11**

Weighting: **25%**

The practical work (synthesis and antibacterial structure activity relationship of sulfonamides) will be conducted in groups, with ~6 people per group.

1. You will prepare a group report in the style of a PATENT application by **midday Week 14, Tuesday June 11 (5% group mark and 5% individual mark)**. This will also require submission of every group member's lab book.
2. In the **Week 1, Friday March 1 lab**, each group will develop a written justification of their choice of final target compounds and possible synthetic procedures (this contributes to your participation mark under point 5).
3. In **week 7 (Friday April 12 by 6pm)**, individual laboratory notebooks (hardcopy) will be submitted for marking **AND** each group will submit a formal write up of the experimental procedure ("Examples" section of the patent) for the synthesis of one of your sulfonamide products EACH, including spectral data. So if you have 6 group member, 6 examples are required (**5%** individual mark, no group mark). The Examples sections needs to be provided as one group document though marks will be allocated to individuals for their contribution.
4. In **week 10, Tuesday May 21** (by midday), each group will submit the "Technical Field", "Background of the Invention" and "Object of the Invention" sections as a hardcopy (not through turn-it-in) of their group's patent, written in patent format (**5%** group mark).
5. By **midday week 14, Tuesday June 11**, individual laboratory notebooks will be submitted for marking (**5%** individual mark). General safety and participation in the laboratory will also be considered in the mark.

Full details on what is expected for assessment of the practical component is provided in the laboratory manual and on the web site (see under “Laboratory Notes”).

On successful completion you will be able to:

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental results to solve related problems.
- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## Spectroscopy Training

Due: **April 8**

Weighting: **0%**

All students are required to undertake the Kahn Academy course on spectroscopy before week 7. Please start this task in week 1 and make a plan to complete all modules by the end of week 6. <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay>.

On successful completion you will be able to:

- By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental

results to solve related problems.

## Mid-semester test

Due: **May 7**

Weighting: **15%**

There will be a 50 minute test (/15%) in **Week 9, Tuesday May 7, 1 PM in the lecture session**. This will cover up to the end of prodrugs. This is designed to give you specific feedback on your understanding of the topics up to this stage to assist you in your further study of the unit.

On successful completion you will be able to:

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## Quizzes

Due: **in lectures and online**

Weighting: **5%**

Short quizzes (/5%) may be conducted at any time. Quizzes will also be conducted online. They are to allow identification of any deficiency in knowledge and understanding and to encourage continuous learning of the lecture material without the stress of a significant assessment component. Quizzes may contain questions from the spectroscopy workshop.

On successful completion you will be able to:

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of



action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.

- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## Pharmaceutical Agent Report

Due: **April 30**

Weighting: **5%**

You will write a report on a clinically used pharmaceutical agent, providing information on its structure and function at a molecular level. This is due in the **week 8, April 30** before 6 PM. This will help in your consolidation of the medicinal chemistry concepts taught. The format is 2000 word essay, not including figures, tables or references. **All work must be submitted through turnitin.** This assignment is designed to provide skills in searching the literature, scientific writing, and understanding the properties of the pharmaceutical agent from a molecular point of view.

On successful completion you will be able to:

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.



## Final exam

Due: **week 15 (to be confirmed)**

Weighting: **50%**

The final exam (/50%) will be 3 hours in length with 10 minutes reading time. It is designed to assess specific understanding and holistic concepts of all the topics presented within the course and an opportunity for you to show what knowledge you have obtained and how you can apply this in new situations to solve complex problems.

On successful completion you will be able to:

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## Delivery and Resources

### Unit Web Page

The web page for this unit can be found at [ilearn.mq.edu.au](https://ilearn.mq.edu.au).

Just login and follow the prompts to CBMS306/606 Medicinal Chemistry.

You can use any web browser such as Firefox, Internet Explorer or Safari to login.

iLearn is the name for Macquarie University's Learning Management System (LMS). The iLearn online learning environment enables learning, teaching, communication and collaboration. It is used to make lecture notes, laboratory notes, discussion forums, digital lecture recordings and other learning resources available to students online.

CBMS606 is a 3 credit point unit and will require an average of 10 hours of work (contact and self study time) per week over the 15 weeks. For students with weak chemistry backgrounds, more time per week will probably be necessary to perform satisfactorily in this unit. CBMS606 is run with three hours of lectures/tutorials per week, along with 4 hour blocks of laboratories/

workshops. Students are expected to attend all lectures, tutorials and laboratory classes. Active participation by the students in all of these fora is encouraged.

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions. Some lecture material will be available on the unit web site, while other material will be provided in the lecture class. Learning is an active process, and as such, you must engage with the material. This means reading the textbook (and beyond) before and after lectures, attempting the assignment questions and other questions, discussing the concepts with your classmates and lecturers. Do not be afraid to ask questions – everyone benefits from a robust and open discussion of the topics.
- Quizzes and a mid session test will also be run in the lecture session. The in class quizzes will cover any material prior to that day's lecture, therefore all students are expected to keep up to date with lecture material through revision each week. Online quizzes are also provided, with accompanying resources. The quizzes and mid session test are designed to allow you to continuously learn and to identify what you understand and the areas that you need to spend more time on, with minimal assessment penalty.
- All laboratory experiments will be conducted in groups. These have a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. This laboratory work is designed to give real life experiences in research by involving students in the design of the experiments, using literature procedures as a guide, and trouble shooting to identify the best experimental conditions. It will emphasise the importance of being highly prepared for all experiments and being fully aware of all safety procedures, proper recording and reporting of all data and interpreting of all results, and having an analytical and inquisitive approach.

Further information on technology used: You are expected to access the unit web site frequently. This contains important information including notes on the topics to be covered; the laboratory manual; What You Need to Know Sheets; your marks for practicals, quizzes and the mid-session exam; and past exam papers, including with answers. Additionally, the web site will also be used to post important messages and links to internet facilities and sites of relevance to the course, downloadable software, and lots of other interesting material.

All students are required to undertake the Kahn Academy course on spectroscopy before the end of the mid-semester break <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay>. There are also resources in the library (PDF file in special reserve to help you with this).

If you do not have your own computer you may wish to access the Medicinal Chemistry web resources on campus using the PC computers in the Library or in the C5C computer

laboratories. To view notes on all the topics and past exams on the unit web site, you will require Adobe Acrobat Reader Version 9 or later to be installed on your computer. Acrobat Reader can be downloaded from the Adobe web site <https://get.adobe.com/reader/?loc=uk>. If you are using the computers in the library, then Acrobat has already been installed. Please note information will also be sent by email to your student email account so please look at your email account on a frequent basis.

You are expected to access SciFinder Scholar and Reaxys to assist in searching the literature. These are available through the library web site.

Hand-held calculators will be occasionally used in tutorials and practicals, for tests and in the final examination. Note that text-retrieval calculators are not allowed in the in-semester tests or final examination.

## Unit Schedule

### Lectures/tutorials:

The first 75% of CBMS606 will provide an overview of the important concepts in medicinal chemistry and the last 25% will concentrate on case studies. CBMS606 has three hours/week allocated to lectures/tutorials. While formal lectures will be presented, discussion sessions will also form a major part of the classes. This will be supplemented by practical classes utilising synthetic chemistry, spectroscopic methods and bioassays.

The laboratory classes will be run in groups and students are required to, in part, design the experiments, using literature procedures as a guide. Considerable preparation is therefore needed. Past students have found this a valuable experience as it gives them a realistic approach to conducting research. The laboratory classes will run every week, Friday 2-6 pm except the mid-session break and week 13. The week 13 lab class time will be used for the final laboratory report (patent) preparation.

In week 1, the laboratory class will be a preparative session, in which the groups will discuss structure-activity relationships and use this to rationally choose their target sulfonamides, learn how to use SciFinder Scholar and Reaxys for literature searching and start to identify key preparative methods for the sulfonamides, and prepare flow diagrams and risk assessment forms for commencement of the wet laboratory classes (beginning week 2).

This week 1 preparative session will be run in the lab room 14SCOA 308 (E7B308; first year labs, unless otherwise indicated), and commence at 2 pm. The laboratory classes will run from week 2 in laboratory 14SCOA 349/350 (E7B349/350; unless otherwise indicated). The 2-6pm session of week 13 will be used for finalising the laboratory report and the write-up room will be available for this.

### Topics

### Lect/Tut Lecturer

- |  |        |       |
|--|--------|-------|
| • Overview of Medicinal Chemistry                          | wk 1-2 | PK/JJ |
| • Cellular targets ('receptors') for drug action           |        |       |
| • Binding of drugs to 'receptors'                          |        |       |
| • Interaction of 'receptors' with agonists and antagonists |        |       |

- Protein structure and function wk 2-3 JJ
- Enzyme kinetics
- Interaction of enzymes with inhibitors (competitive, non-competitive)
- Nucleic acids wk 4 JJ
- Drug discovery from nature wk 5-8 JJ
- Drugs from synthesis
- Optimisation of lead compound, structure-activity relationships
- Physicochemical properties of drugs
- Drug absorption, distribution, metabolism and excretion
- Prodrugs
- Quantitative structure-activity relationships wk 9-10 PK
- Combinatorial Chemistry
- Case Studies
- Case 1 (G-coupled protein receptor agonists and antagonists) PK
- 3 minute Pharmaceutical agent presentations wk 10 JJ
- Antibacterial agents wk 11-12 AP
- Discussion of sulfonamide antibacterial assays and lab report wk 13 JJ/PK
- Revision wk 12-13 JJ/AP

## Learning and Teaching Activities

### Lectures/tutorials

Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.

### Practicals

All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## 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.*)

Undergraduate 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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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](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 improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## 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](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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/](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.

## Graduate Capabilities

### Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

### Learning outcomes

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

### Assessment tasks

- Provisional Patent Application
- Pharmaceutical Agent Report

### Learning and teaching activities

- Lectures will be presented as a combination of formal lectures and interactive tutorial

sessions.

- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

### Learning outcomes

- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

### Assessment tasks

- Provisional Patent Application
- Pharmaceutical Agent Report

### Learning and teaching activities

- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.



## Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

### Learning outcomes

- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

### Assessment tasks

- Spectroscopy Training
- Quizzes
- Final exam

### Learning and teaching activities

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.

## Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

### Learning outcomes

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a

molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.

- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental results to solve related problems.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## **Assessment tasks**

- Provisional Patent Application
- Spectroscopy Training
- Mid-semester test
- Quizzes
- Pharmaceutical Agent Report
- Final exam

## **Learning and teaching activities**

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.
- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## **Critical, Analytical and Integrative Thinking**

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate

and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

## **Learning outcomes**

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental results to solve related problems.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## **Assessment tasks**

- Provisional Patent Application
- Final exam

## **Learning and teaching activities**

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.
- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group

in the form of a provisional patent.

## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

### Learning outcomes

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to execute laboratory skills (synthesis, purification and instrumental and spectral analysis) in a safe manner, accurately record laboratory observations in an appropriate scientific manner, and analyse experimental results to solve related problems.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

### Assessment tasks

- Provisional Patent Application
- Mid-semester test
- Final exam

### Learning and teaching activities

- Lectures will be presented as a combination of formal lectures and interactive tutorial

sessions.

- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

### Learning outcomes

- By the end of this unit, you should be able to describe: the structure and function of biological targets and the interaction of drugs or drug leads with these targets at a molecular level; methods of drug discovery and development; qualitative and quantitative structure–activity relationship methods; pharmacokinetics; the design of more active, selective or less toxic drugs; drug metabolism and prodrugs; and the mechanism of action of specific classes of drugs (e.g. anticancer and antibacterial agents). You should also be able to rationally analyse data and solve problems using these medicinal chemistry principles.
- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

### Assessment tasks

- Provisional Patent Application
- Mid-semester test
- Pharmaceutical Agent Report

- Final exam

## Learning and teaching activities

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.
- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

## Learning outcomes

- By the end of the unit you should be able to use the primary literature and scientific databases (SciFinder and Reaxys) to plan and execute the synthesis of druglike molecules and undertake literature reviews.
- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.
- By the end of this unit, you should be able to communicate medicinal chemistry concepts competently in oral presentations and in written format in exams, tests and laboratory reports and communicate conclusions based on experiments in the form of written reports.

## Assessment tasks

- Provisional Patent Application
- Pharmaceutical Agent Report

## Learning and teaching activities

- Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.
- All laboratory experiments will be conducted in groups using a highly collaborative and

investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

### Learning outcome

- By the end of this unit, you should be able to work with colleagues and conduct group work in an ethical, safe and harmonious way.

### Assessment task

- Provisional Patent Application

### Learning and teaching activity

- All laboratory experiments will be conducted in groups using a highly collaborative and investigative approach, where you will be designing and synthesising a series of sulfonamides and subsequently testing them for antibacterial activity to determine the important features for their antibacterial activity. You will write up your results as a group in the form of a provisional patent.

## Changes from Previous Offering

The unit is being run similarly to 2018 with these exceptions:

- 1) requirement of completion of a spectroscopy workshop (on-line)
- 2) drafting of your group lab results as a Provisional Patent rather than a paper for J. Med. Chem.
- 3) different marking scheme for the practical component
- 4) Pharmaceutical agent assignment is a written assignment (no oral)
- 5) Prof. Karuso is convening the unit instead of Assoc. Prof. Jamie.

## Other Teaching Staff

Peter Karuso and Joanne Jamie are the main teaching staff in this unit. There are no formal office hours for the teaching staff, however, you are expected to contact them on any questions



you have with their topics and the unit convenor (Peter Karuso) on any administrative questions as soon as your concern arises. You are encouraged to phone or email to organise a meeting. You may also wish to ask questions using the discussion board on the website.