

# **PHAR3102**

## **Molecular Pharmacology**

**Course Outline**  
**Term 1, 2022**

**School of Medical Sciences**  
**Faculty of Medicine & Health**

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# 1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Dr Angela Finch	a.finch@unsw.edu.au	By appointment	90651017
Co-Convenor	A/Prof Nicola Smith	nicola.smith@unsw.edu.au	By appointment	
Lecturer	Dr Trevor Lewis	t.lewis@unsw.edu.au	By appointment	
Lecturer	A/Prof Lu Liu	lu.liu@unsw.edu.au	By appointment	
Lecturer	Dr Nicole Jones	n.jones@unsw.edu.au	By appointment	

## 2. Course information

Units of credit: 6

Prerequisite: PHAR2011. Highly recommended BIOC2201 or BIOC2101 or BIOC2181

Teaching times and locations: <http://timetable.unsw.edu.au/2022/PHAR3102.html>

### 2.1 Course summary

You will learn the molecular basis of drug action and explore how cutting-edge biotechnology and biomedical research advances pharmacological knowledge. Detailed coverage includes: genetic variability in drug action, protein structure-activity relationships, receptor-ligand interactions, signal transduction, biochemical and molecular aspects of drug targets and their signalling mechanisms. The course has a strong focus on developing research and analytical skills.

### 2.2 Course aims

Building on basic pharmacology skills learned in PHAR2011, the objectives of this course are to

- Explore the basis for drug actions at the molecular level from binding to a target to eliciting a cellular outcome
- To develop an understanding of why certain molecules might be agonists, antagonists or inverse agonists and the circumstances under which these definitions might change
- Develop an appreciation of how cellular context and genetic variability can impact the effect of a drug at the molecular level
- To develop skills in the interpretation and analysis of molecular pharmacology experiments and ability to decide whether the data supports the conclusions made by the scientist

## 2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Apply knowledge of molecular pharmacology of drug targets to pharmacological problems
2. Describe the effect of genetic variability on drug action
3. Apply knowledge of molecular biology techniques to the design of experiments to test molecular pharmacology hypotheses
4. Record, analyse and/or draw conclusions from experimental data

## 2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Related Tasks & Assessment
CLO 1	Apply knowledge of molecular pharmacology of drug targets to pharmacological problems	1, 2, 3, 4
CLO 2	Describe the effect of genetic variability on drug action	1, 2, 3, 4
CLO 3	Apply knowledge of molecular biology techniques to the design of experiments to test molecular pharmacology hypotheses	1, 2, 3, 4
CLO 4	Record, analyse and/or draw conclusions from experimental data	1, 2, 3, 4

## 3. Strategies and approaches to learning

### 3.1 Learning and teaching activities

The learning and teaching philosophy underpinning this course is centred on you gaining core skills and developing an understanding of the molecular basis of drug action. We aim to create an environment which interests and challenges you. The teaching is designed to be engaging and relevant in order to prepare you for future careers. The primary source of information for this course is the lecture material, with the collaborative learning sessions, practical classes and online material directly complementing and supporting the lecture material. Additionally, effective learning can also be enhanced through self-directed use of other resources such as textbooks, literature references and web-based sources.

Learning activities occur on the following days and times:

**Lectures:** Topics being covered each week can be found on the course timetable. The topics will be covered via pre-recorded lectures or online modules and will be available online prior to the week scheduled.

**Collaborative learning session:** You should attend one session per week, delivered face to face (or online for approved students) on Tuesday at either 4 – 5 pm or 5 - 6 pm

**Laboratory practicals:** You should attend the laboratory practicals to be held face to face (or online for approved students) on Thursdays 10 am – 1 pm. The practicals are a core part of your learning experience in the sciences.

**Q & A sessions:** Online on Friday 9 – 10 am.

**Mid-session exam:** Week 5 (covers content from weeks 1-4) and will be held during the Q & A time slot of week 5.

Information regarding weekly activities will be available via the interactive timetable on Moodle and in weekly announcements via Moodle.

### 3.2 Expectations of students

Students are reminded that UNSW recommends that a 6 units-of-credit course should involve about 150 hours of study and learning activities. The formal learning activities total approximately 60 hours throughout the term and students are expected (and strongly recommended) to do at least the same number of hours of additional study.

The *Q&A sessions* are provided to allow you the opportunity to clarify points covered in each week's topics. You should review the weeks topics and make notes well in advance of the Q&A session. You should then review your notes and write down any questions you have about these topics and bring those questions along to the Q&A session.

The *practicals* are provided to support lecture material and practise analytical and critical evaluation skills.

In the *collaborative learning sessions*, you will work in teams to learn about techniques used in molecular pharmacology. You will then apply this knowledge in the critical analysis and interpretation of data presented in a journal article. These sessions will allow you to develop your research, information literacy, critical analysis, communication and time management skills.

The practical classes and collaborative learning sessions help you to achieve course learning outcomes 1-4. You need to complete any preparation work set prior to attending these classes. This might include pre-lab modules, reading of information sheets or answering of Journal Club questions. Attendance at practical classes and collaborative learning sessions will be recorded at the start of each class.

If you wish to contact the course convenors or staff, you can do so by e-mail or Microsoft Teams, using the details provided in section 1 of this document and on the course Moodle page. We are committed to providing the best experience and outcome for all students and will therefore endeavour to respond to e-mails as soon as possible, but please consider the following:

- Standard work hours are Monday to Friday from 8 am to 6 pm. E-mail correspondence received outside of this time may be dealt with from the next working day.
- All staff and students have busy schedules and multiple commitments, so while staff will endeavour to answer e-mail correspondence as quickly as possible, please apply appropriate expectations in this regard (i.e. within 48 hours and on a workday).
- Please only use Teams messaging to communicate with the course staff *during class*. Outside of class please use e-mail.
- All digital correspondence, including e-mail, Teams messages, and messages on discussion forums should be respectful, courteous, and polite.

To help us improve the course, please consider providing us with feedback by acting as a student liaison, and/or by completing the MyExperience survey later in the term.

## 4. Course schedule and structure

This course consists of 45 hours of class contact hours. You are expected to take an additional 100 hours of non-class contact hours to review online topics (lectures), complete assessments and class preparation activities, and study and revision in preparation for exams.

Week	Topic	Activity [Learning opportunity]	Related CLO
<b>Week 1</b>	<ul style="list-style-type: none"> <li>• Introduction to Molecular Pharmacology</li> <li>• GPCRs:               <ul style="list-style-type: none"> <li>○ Introduction to the Families</li> <li>○ Activation Mechanism</li> </ul> </li> </ul>	CLS - Introduction Practical- Introduction Q&A	1, 3, 4
<b>Week 2</b>	<ul style="list-style-type: none"> <li>• Advanced Pharmacodynamics               <ul style="list-style-type: none"> <li>○ Measuring drug response</li> <li>○ Binding kinetics</li> </ul> </li> </ul>	CLS - Molecular Techniques-BRET / CRISPR Practical- Determining Antagonist Potency Q&A	1, 3, 4
<b>Week 3</b>	<ul style="list-style-type: none"> <li>• Second Messengers</li> <li>• G proteins               <ul style="list-style-type: none"> <li>○ Introduction to G proteins &amp; G <math>\alpha</math> subunits</li> <li>○ G <math>\beta\gamma</math> subunits</li> </ul> </li> </ul>	CLS - Journal Club Practical- Receptor binding Q&A	1, 3, 4
<b>Week 4</b>	<ul style="list-style-type: none"> <li>• Constitutively Active Receptors/ Inverse agonists</li> <li>• Regulation of GPCR Signalling Internalisation &amp; Endosomal Signalling</li> </ul>	CLS - Molecular Techniques- Confocal / Western Blot Practical- Receptor Signalling Q&A	1, 3, 4
<b>Week 5</b>	<ul style="list-style-type: none"> <li>• Receptor Theory:               <ul style="list-style-type: none"> <li>○ Occupation and Operational Models</li> <li>○ Ternary Complex Model and ETCM</li> <li>○ Induced Fit vs Conformational Selection</li> </ul> </li> </ul>	CLS - Journal Club Practical- Receptor Signalling Q&A	1, 3, 4
<b>Week 7</b>	<ul style="list-style-type: none"> <li>• Biased Signalling</li> <li>• Allosteric Modulators</li> </ul>	CLS -Molecular Techniques - $\alpha$ -screen / Radial plots Practical- Receptor Signalling Q&A	1, 3, 4
<b>Week 8</b>	<ul style="list-style-type: none"> <li>• Orphan Receptors</li> <li>• Ligand-Gated Ion Channel</li> </ul>	CLS - Journal Club Practical- Receptor Signalling Q&A	1, 3, 4
<b>Week 9</b>	<ul style="list-style-type: none"> <li>• Nuclear Receptors /Transcription Factors</li> <li>• Pharmacogenetics/genomics</li> </ul>	CLS - Molecular Techniques- EMSA / RGA Practical- Receptor Signalling Q&A	1, 2, 3, 4
<b>Week 10</b>	<ul style="list-style-type: none"> <li>• Transporters</li> <li>• Catalytic Receptors</li> </ul>	CLS – Journal Club Practical- Pharmacogenetics Q&A	1, 3, 4

Exam Period: 29 April – 12 May

Supplementary Exam Period: 23 May – 27 May

## 5. Assessment

### 5.1 Assessment tasks

Assessment task	Length	Weight	Mark	Due date and time
<b>Assessment 1:</b> Progress Exam	50 min	15	100	18 <sup>th</sup> March 9 am
<b>Assessment 2:</b> Laboratory Notebook	See task description for details	15	100	Weeks 3, 4 & 10 Monday 10 am
<b>Assessment 3:</b> Collaborative Learning Activities	See task description for details	15	100	Weeks 2-5, 7-10
<b>Assessment 3:</b> Final Exam	2 h	55	100	Exam Period: 29 April – 12 May

**Assessment 1: Mid-term Progress Exam.** This exam will give you feedback on how you are succeeding in the course. It will test not only your knowledge of the molecular pharmacology of receptors, and molecular techniques used in pharmacology but also your ability to apply the knowledge you have acquired from multiple lectures, collaborative learning sessions and practicals to molecular pharmacology scenarios. The examinations may be in the format of MCQ, short and long answer questions. The questions will be based on the material covered in the lectures, practical classes and collaborative learning sessions. Material covered prior to the progress exam may again be examined in the final exam.

**Assessment 2: Laboratory Notebook.** Students will record the details of each experiment performed during the practical classes, collect and analyse data, and draw conclusions from the data generated.

#### **Assessment 3: Collaborative Learning Activities**

Part 1: Molecular Technique Quizzes: Students will take online quizzes covering the application of molecular techniques to pharmacological studies, and the interpretation and analysis of molecular pharmacology experiments (5 quizzes, 5%).

Part 2: Journal Club: 'Journal Club' will be scheduled every second week. You will answer questions that guide you through the process of analysing and drawing conclusions from data presented in a research article that has used the molecular techniques taught in the collaborative learning session the week before. You will submit answers to these questions prior to each 'journal club'. At the end of term you will reflect on your critical analysis learning trajectory and nominate your "best" attempt at answering the questions for marking. (10%)

**Assessment 4: Final examination.** The end of session examination will test not only your knowledge of the molecular pharmacology of receptors, channels and transporters, and molecular techniques used in pharmacology, but also your ability to apply the knowledge you have acquired from multiple lectures,

collaborative learning sessions and practicals to molecular pharmacology scenarios. The examinations may be in the format of MCQ, short and long answer questions. The questions will be based on the material covered in the lectures, practical classes and collaborative learning sessions.

### Further information

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

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

## 5.2 Assessment criteria and standards

Practice exam questions will be made available to you via Moodle, as well as during the collaborative learning sessions.

Details regarding the assessment tasks will be provided to you during the first laboratory practical session and first collaborative learning session in week 1, as well as being available on the course Moodle page. A detailed marking rubric for each task will be provided to you via the course Moodle page.

## 5.3 Submission of assessment tasks

### Late Submission

Late submissions will be penalized at 5% per day capped at five days (120 hours). Students will not be permitted to submit their assessments after this date.

### Special Consideration

If you experience a short-term event beyond your control (exceptional circumstances) that impacts your performance in a particular assessment task, you can apply for Special Consideration.

You must apply for Special Consideration **before** the start of your exam or due date for your assessment, except where your circumstances of illness or misadventure stop you from doing so.

If your circumstances stop you from applying before your exam or assessment due date, you must **apply within 3 working days** of the assessment, or the period covered by your supporting documentation.

More information can be found on the [Special Consideration website](#).

## 5.4. Feedback on assessment

**Assessment 1: Mid-term test.** Individual marks are provided via Moodle once the exams have been graded. Cohort feedback is provided in the form of a post or podcast via the course Moodle page in week 7.

**Assessment 2: Laboratory Notebook.** You will be receiving formative feedback during practical classes and 3 times during the term your laboratory notebook will be graded. After each submission you will receive summative written feedback. A marking rubric will be used to evaluate the laboratory notebooks and provide feedback.

### Assessment 3: Collaborative Learning Activities

Part 1: Molecular Technique Quizzes: Feedback will be provided in class once the quiz is completed.

Part 2: Journal Club. You will receive feedback on how well you are analysing the journal article during class as part of the class discussion of the paper. A marking rubric will be used to evaluate your submission and written feedback on your reflection will be provided.

**Assessment 4:** Final examination. Cohort feedback is provided once the exams are completed in the form of a post in Moodle.

## 6. Academic integrity, referencing 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.

Please use Vancouver referencing style for this course.

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.<sup>1</sup> 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 and **plagiarism** can be located at:

- The Current Students site <https://student.unsw.edu.au/plagiarism>, and
- The ELISE training site <http://subjectguides.library.unsw.edu.au/elise/presenting>

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

## 7. Readings and resources

Due to the cutting-edge nature of this course and the rapid advances made in the field of Molecular Pharmacology, a single primary text which adequately covers the content of this course has not been identified. Therefore, each lecturer will provide you with additional resources to supplement their lecture material. These resources will take the form of textbooks, journal articles or web-based resources. If available, links to the electronic form of these resources will be put on the course Moodle page.

Three textbooks have been identified that together cover the majority of the course content. These texts are available as online resources from the UNSW library

- "Pharmacology in drug discovery: understanding drug response" by T. P. Kenakin.
- "Molecular Pharmacology: From DNA to Drug Discovery" by Dickenson, Freeman, Lloyd Mills, Thode, & Sivasubramaniam.

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<sup>1</sup> International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

- “General and Molecular Pharmacology: Principles of Drug Action” Edited by Francesco Clementi and Guido Fumagalli, will be used as an additional reference text throughout the course.

## 8. Administrative matters

Student enquiries should be submitted via student portal <https://portal.insight.unsw.edu.au/web-forms/>

## 9. Additional support for students

- The Current Students Gateway: <https://student.unsw.edu.au/>
- Academic Skills and Support: <https://student.unsw.edu.au/academic-skills>
- *Student Wellbeing and Health* <https://www.student.unsw.edu.au/wellbeing>
- UNSW IT Service Centre: <https://www.myit.unsw.edu.au/services/students>
- *UNSW Student Life Hub*: <https://student.unsw.edu.au/hub#main-content>
- *Student Support and Development*: <https://student.unsw.edu.au/support>
- *IT, eLearning and Apps*: <https://student.unsw.edu.au/elearning>
- *Student Support and Success Advisors*: <https://student.unsw.edu.au/advisors>
- *Equitable Learning Services (Formerly Disability Support Unit)*: <https://student.unsw.edu.au/els>
- *Transitioning to Online Learning* <https://www.covid19studyonline.unsw.edu.au/>
- *Guide to Online Study* <https://student.unsw.edu.au/online-study>