



UNSW
AUSTRALIA

Medical Sciences
Medicine

DEPARTMENT OF PHARMACOLOGY

PHAR2011

INTRODUCTORY PHARMACOLOGY AND TOXICOLOGY

COURSE OUTLINE

SESSION 2, 2016

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Please check the SoMS science page for updates, timetable information and additional student guides and resources:

<http://medicallsciences.med.unsw.edu.au/students/undergraduate/science>

PHAR2011 COURSE INFORMATION

UNITS OF CREDIT (UOC)

PHAR 2011 Introductory Pharmacology and Toxicology is a 2nd year Science Course with 6 Unit of Credit (UOC).

PREREQUISITES

Enrolment requirements: 6 UOC level I Mathematics
 6 UOC level I Biology (BABS1201 preferred)
 12 UOC level I Chemistry
 6 UOC Physiology 1A

(Note: 3992 Medicinal Chemistry students receive a special exemption from requiring Physiology 1A)

OBJECTIVES OF THE COURSE

To gain:

- an understanding of the principles of pharmacology
- an appreciation of the mechanisms by which drugs act
- an understanding of the mechanisms by which toxic chemicals disrupt cellular processes

COURSE CO-ORDINATORS

Course Coordinator:

A/Professor Lu Liu Room 325, Wallace Wurth East
 Phone: 9385 8762
 Email: Lu.Liu@unsw.edu.au
 Consultation times: by email or phone arrangement

Co-coordinator:

Dr Trudie Binder Room 216, Wallace Wurth
 Phone: 9385 8737
 E-mail: W.Binder@unsw.edu.au
 Consultation time: by appointment via email or phone

LECTURERS AND TUTORS IN THIS COURSE

Lecturers:

Dr. Trudie Binder W.Binder@unsw.edu.au
Dr. Angela Finch A.Finch@unsw.edu.au
Dr. Ross Grant R.Grant@unsw.edu.au
Dr. Nicole Jones N.Jones@unsw.edu.au
A/Professor Lu Liu Lu.Liu@unsw.edu.au

Tutors: TBC

COURSE STRUCTURE AND TEACHING STRATEGIES

This 6 UOC consists of:

- 2 lectures per week
- Practical / tutorial sessions of up to 4 hours per week

Lectures: Tue 1-2 pm and Wed 1-2 pm (week 1-12)

Tutorials: Tue 2-3 pm, or Wed 3-4 pm, or Wed 4-5 pm (week 2-13)

Practicals: Monday 10 am-1 pm, or 2-5 pm (week 1-12)

You are expected to attend all scheduled activities for the full duration. You are reminded that UNSW recommends that a 6 UOC course should involve about 125-150 hours of study and learning activities. Apart from the formal learning activities you are strongly recommended to do your own studies throughout the semester.

Lectures will provide you with the concepts and theory essential for understanding Introductory Pharmacology. To assist in the development of research and analytical skills practical classes and tutorials will be held. As these classes are relatively small, they allow you to engage in a more interactive form of learning than is possible in the larger class lectures. The skills you will learn in practical classes are relevant in your development as professional scientists.

APPROACH TO LEARNING AND TEACHING

The learning and teaching philosophy underpinning this course is centred on student learning and aims to create an environment, which interests, challenges and enthuses students. The teaching is designed to be relevant and engaging in order to prepare students for future careers.

The primary source of information for this course is the lecture material, and the tutorials and practical classes will be directly related to the lectures. Nevertheless, effective learning can also be enhanced through self-directed use of other resources such as textbooks, literature references and web based sources. Your practical classes will be directly related to the lectures and you are advised to prepare for practical classes before attendance. It is up to you to ensure you perform well in each part of the course; preparing for classes; completing assignments; studying for exams and seeking assistance to clarify your understanding. Past exam questions are provided to assist you in preparing for examinations.

This course will be parallel taught with Pharmacology for Health and Exercise Science PHAR2211.

TEXTBOOK AND READING LIST

Prescribed textbook:

- Rang and Dale's Pharmacology. 8th ed. Churchill Livingstone/Elsevier.

Recommended textbooks:

- Goodman and Gilman's The Pharmacological Basis of Therapeutics. 12th ed. McGraw-Hill Companies, c2011. (The e-book is available through UNSW Library Resources database: Access Medicine):
<http://accessmedicine.mhmedical.com/book.aspx?bookid=1613>
- Katzung et al., Basic and Clinical Pharmacology. 13th ed. McGraw-Hill. (The e-book is available through UNSW Library Resources database: Access Medicine):
<http://accessmedicine.mhmedical.com/book.aspx?bookid=1193>

All textbooks are available from the UNSW Bookshop.

STUDENT LEARNING OUTCOMES

A) Discipline specific learning outcomes

On completion of this subject students will be able to:

- Apply pharmacological approaches to problem solving
- Participate effectively in group work
- Apply quantitative analysis to pharmacological data
- Organise information into a clear report
- Have gained a basic knowledge of Pharmacology exemplified by the themes: How Drugs work; Autonomic Pharmacology; The use of Drugs; Alternative Sources of Drugs and Drug handling by the body.

B) Skills based learning outcomes

Underlying PHAR2011 will be an emphasis on Graduate Attributes which include the skills, qualities, understanding and attitudes that promote lifelong learning that you should acquire during your university experience.

- Research, inquiry and analytical thinking abilities
- The capability and motivation for intellectual development
- Ethical, social and professional understanding
- Effective communication
- Teamwork, collaborative and management skills
- Information Literacy – the skills to locate, evaluate and use relevant information.

ASSESSMENT PROCEDURES

	% total marks
Mid-session test (20 MCQs and 2 SAQs, 45 min duration)	20%
Assignment	20%
Lab quiz (2 quizzes, each worth 2.5%)	5%
Online quiz	5%
Final exam (2 hours duration) 20 MCQs and 10 SAQs	50%

The mid-session test (progress examination) will be held during the session on the **6th of September (week 7)**. This exam will give you feedback on how you are succeeding in the course. The test will consist of 20 multiple choice questions (MCQs) and 2 x 5 min short answer questions (SAQs) and will be based on the material covered in the lectures, practical classes and tutorials. Material covered prior to the progress exam may be again examined in the final exam.

The written assignment task will allow you to develop your research, information literacy, communication and time management skills. Your assignment must be submitted electronically via Moodle, through Turnitin and a hard copy submitted to G27, Biosciences Building. A penalty of 10% per day will apply for late submissions. Please check Moodle under "Assignment" for the detailed information about the commentary assignment.

The practicals and tutorials are provided to support lecture material and practise analytical skills. The practical classes and tutorials help you to develop graduate attributes. During the practical course you will be required to participate in two lab quizzes to test your knowledge

of the concepts and preparation for the labs. You will get feedback at the end of each quiz.

The online quiz is a formative assessment, which is created to help you revise the teaching contents and become familiar with the MCQ format. You will receive assessment results and feedback immediately once the task is finished.

The end of session examination will be held during the official examination period. **The examinable material consists of what is covered in lectures, tutorials and practicals classes.**

MISSED ASSESSMENT ITEMS

If in any circumstances you unavoidably miss the final exam, mid-session test or cannot hand in assignment on time, **you must inform the course coordinator and you must lodge a special consideration request**, supported by a medical certificate or other documentation to Student Central within **3 DAYS**.

Your request for consideration will be assessed. If approved, the following permissions may be granted:

- i). For missed mid-session test: NO supplementary mid-session test will be offered. Your mark in the final exam will be re-weighted to include the mark reserved for the missed mid-session test.
- ii). For late assignment submission: a maximum of one week extension may be granted.
- iii). For missed final exam: a supplementary final examination will be held – the dates for the supplementary exams will be December 6, 7 or 8 and will be run by the BSB office.

Normally, if you miss an exam (without valid reasons) you will be given an absent fail. If you arrive late for an exam no time extension will be granted. It is your responsibility to check timetables and ensure that you arrive with sufficient time.

MISSED PRACTICAL AND TUTORIAL CLASSES

Attendance at practical and tutorial classes is considered compulsory. Students are required to attend a minimum of 80% of the classes. Students who miss practical or tutorial classes due to illness or for other reasons must submit or email a copy of medical certificates or other acceptable documentation to the course coordinator **within 3 days after an absence**. Certificates submitted after 3 days will not be accepted. The following details must be attached: Name, Subject number, Date of the class, Name of class/es missed.

For missed lab quiz: NO supplementary test will be offered. Your mark in the final exam will be re-weighted to include the mark reserved for the missed lab quiz.

Students who miss the lab quiz due to absence or late without an adequate reason /documentation will receive no marks for the missed lab quiz.

REPEATING STUDENTS

Practical class exemptions may be granted to repeat students but you **must** check with the course coordinator whether you have exemption **prior** to your first practical class. All students must be familiar with the material covered in the practical classes.

HANDWRITING

Students whose writing is difficult to understand will disadvantage themselves in written assessments. Make every effort to write clearly and legibly. Do not use your own

abbreviations.

TEACHING RESOURCES

The Department of Pharmacology has chosen to use the University's central Moodle service to provide teaching materials for all of its courses. See moodle.telt.unsw.edu.au

After logging on to Moodle, look for the course PHAR2011. You should have access to it if you are properly enrolled.

GENERAL INFORMATION

The Department of Pharmacology is part of the School of Medical Sciences (SoMS) and is within the Faculty of Medicine. It is located in the Wallace Wurth East building. General inquiries can be made at the BABS.SOMS.BEES (B.S.B.) Student Office, located on the Ground Floor Room G27, of the Biosciences Building. Office hours are 9.00 am - 5:00pm.

Professor Margaret Morris is Head of the Department of Pharmacology. Appointments with Prof Morris may be made through her Administrative Assistant Chris Riordan (C.Riordan@unsw.edu.au) in the SoMS Administration area, Room 255 Level 2, Wallace Wurth West.

Postgraduate research degrees: The Department of Pharmacology offers students the opportunity to enter into **Doctorate (Ph.D)** and **Masters**. For further information contact the coordinator, A/Professor Pascal Carrive (p.carrive@unsw.edu.au, Ph 9385 2467) or Dr David Simar (d.simar@unsw.edu.au, Ph 9385 8142)

The School Teaching Administrator

Ms Justine Maguire-Scarvelliare able to provide additional information on any courses offered by the School. Student enquires counter, located on the Ground Floor of the Biosciences building (G27). Contacts for Ms Maguire-Scarvelliare: j.maguire-scarvelli@unsw.edu.au, Ph: 9385 8301.

REQUIREMENTS FOR PRACTICAL CLASSES

The practical class is an opportunity for students to develop graduate attributes by behaving in an ethical, socially responsible and professional manner within the practical class.

- To help you become familiar with the health and safety issues as well as the important procedures of each practical, there will be a pre-recorded video and a few quiz questions on Moodle, you MUST complete the video and complete quiz at least 1 hour prior to the start of your practical class. This activity will be monitored by the course convenor. Failure to do so will result in delay in finishing the class.
- Punctual arrival is expected.
- Turn off mobile phones before entering the class
- You must read the "Student Risk Assessment" form and sign your name on the form before the lab starts.
- Enclosed shoes are compulsory for all practical classes. Lab coat must be worn for wet labs.

Information on relevant Health and Safety policies and expectations will be provided in the practical notes, as outlined at safety.unsw.edu.au.

Students must take due care with biological and hazardous material and make sure all

equipment is left clean and functional. Those who don't adhere to these basic laboratory rules will be marked absent. Special attention should be paid to any precautionary measures recommended in the notes. If any accidents or incidents occur they should be reported immediately to the demonstrator in charge of the class who will record the incident and recommend what further action is required.

CONSENT FORMS

Practical classes involving your participation as a subject require you to sign a witnessed, informed consent form.

LECTURE OUTLINES

The course is divided into 6 main themes and will cover:

1. How drugs work
2. Autonomic and autacoid pharmacology
3. Drug handling by the body
4. The use of drugs
5. Alternative sources of drugs
6. Toxicology and toxic effects of drugs

1. HOW DRUGS WORK

Introduction to Pharmacology

In this lecture, we will introduce the course, and explore the interdisciplinary nature of pharmacology, looking at the questions that pharmacology and toxicology address. The different subspecialties that make up pharmacology and what they focus on will be discussed. We will also examine the different professions and industries where pharmacological knowledge is applied.

Sites of Drug action: Dose Response

This lecture provides an introduction to pharmacodynamics – what the drug does to the body; it includes: receptors, affinity and efficacy, side effects, desensitisation, up and down regulation, quantitation of drug-receptor interactions, dose-response curves, ED50, and spare receptors.

Agonists and Antagonists

This lecture explores competitive antagonism, irreversible antagonism, functional (physiological) antagonism, chemical antagonism, the concept of tone, potentiation, partial agonist, quantitative response, quantal response, therapeutic ratio and indirectly acting drugs.

Introduction to Receptors

A cell responds to its environment by receiving signals. These signals are received by proteins, known as receptors, which in turn transmit the signal within the cell (this process is termed receptor or cell signalling). Receptors allow the body to detect not only what is happening in the outside world (eg taste, sight, sound, touch) but also what is happening within the body (eg blood pressure, heart rate, glucose metabolism). Receptors can be found either on the cell surface or in intracellular compartments. The main cell surface and intracellular receptor families will be covered

Receptor Signalling

Receptor signalling is the process whereby a receptor relays the stimulus imparted by the binding of the ligand. This often involves a sequence of events mediated by second messengers inside the cell. Calcium's role as a second messenger will be explored. To maintain homeostasis within the cell the termination of signalling must also occur. The role of phosphorylation in signal termination will be covered.

Regulation of Neurotransmitters

This lecture will cover the basic aspects of synthesis, storage and release of monoamines (serotonin, dopamine and noradrenaline) and also cover pathways involved in metabolism and reuptake. In addition, the manipulation of neurotransmitter activity as effective strategies for alleviating various diseases and/or their symptoms will be discussed.

2. AUTONOMIC AND AUTACOID PHARMACOLOGY

Introduction to Autonomic Pharmacology

Introduction to the autonomic nervous system (ANS), i.e. the parasympathetic and sympathetic nervous systems. The integrative action of the ANS. The cholinergic and adrenergic neurotransmissions. Cholinergic and adrenergic receptor classifications.

Cholinergic Mechanisms

Introduction to 3 classes of cholinergic agents: Muscarinics, Nicotinic and Anticholinesterases. Representative agents of each class, mechanisms of action, clinical uses, side effects and contraindications. The action of Botulinum toxin in inhibiting cholinergic exocytosis and its clinical uses will also be discussed.

Adrenergic Mechanisms

Catecholamines. Synthesis and Metabolism of Catecholamines. Adrenergic receptors. Alpha-1 adrenergic agonists and antagonists. Alpha-2 adrenergic agonists and antagonists. Beta adrenergic agonist and antagonists. Indirectly acting sympathomimetic amines.

Autacoids

Autacoids refer to substances produced locally by one group of cells but exert effects on other types of cells in the same region. Autacoids include histamine, serotonin, angiotensin, prostaglandins etc. This lecture will focus on histamine: how it is synthesised in the body, its physiological function and involvement in immune responses; antihistamines in the management of acute allergic reactions. Another important autacoid, serotonin, will also be briefly explored.

3. DRUG HANDLING BY THE BODY

Drug Chemistry & Absorption

Acidic, basic and neutral drugs; relationship between lipid solubility and ionization; characteristics of transfer of drugs across cell membranes, passive diffusion, active transport.

Drug Metabolism

Drug absorption and pathways of metabolism of drugs leading to either inactive or active metabolites. Contribution of Phase I (oxidative) and Phase II (conjugative) pathways to drug metabolism. Factors affecting drug metabolism - other drugs (induction, inhibition), age, disease states, genetic factors. Polymorphic drug metabolism and its consequences. Renal secretion of drugs affecting secretion. Effects of other drugs, protein binding, pH and age on renal elimination. Renal dysfunction and drug elimination.

4. THE USE OF DRUGS

Drugs of Addiction

This lecture encompasses drug dependence and abuse. Patterns of drug use in Australia. Why take drugs? Reward, pleasure and addiction. How drugs act at a cellular level; tolerance, dependence and withdrawal. Different classes of Drugs: Opioids, Alcohol, Stimulants, Cannabis, Hallucinogens, Nicotine.

Anti-inflammatory Drugs

Inflammation is the response of the body to invasion by a pathogen (infection) or injury. This lecture will provide an overview of the therapeutic strategies to treat inflammation.

The lecture encompasses eicosanoid biosynthesis, NSAIDs, paracetamol and DMARDs, including their mechanism of action.

Drugs and Disease: Asthma

This lecture introduces drug treatment and disease, using asthma as an example. Treatments for asthma and associated pharmacology. Bronchial asthma, inflammatory cells and mediators, commonly used anti-asthmatic drugs [β -adrenergic agonists, xanthines, glucocorticoids, oral steroids]. Asthma management, treatment of severe acute asthma, viral infections, novel treatments for asthma.

Peptic Ulcer

Introduction to current views on pathogenesis of peptic ulcer focussing on *Helicobacter pylori*. Factors contributing to *H. pylori*-related gastric pathology; clinical symptoms of gastroduodenal ulcers and diagnostic tests; pharmacological treatment options: e.g. proton pump inhibitors (PPI); histamine H₂ blockers, antacids, combination of antibiotics and PPI.

5. ALTERNATIVE SOURCES OF DRUGS

Alternative Medicine

Alternative medicines describes the use of, generally plant or animal based, preparations not currently established as conventional therapeutic treatments. This lecture will briefly discuss the role of alternative medicines in healthcare and identify key elements for a reasonable evaluation of their use.

Neutraceuticals

The therapeutic effects or side effects of a medication can affect nutritional status. Conversely, diet nutrient supplementation or nutritional status can decrease a drug's efficacy or increase its toxicity. Failure to identify and properly manage drug-nutrient interactions can lead to serious consequences. This lecture outlines drug / nutrient interactions including alterations in pharmacodynamics and pharmacokinetics, the effect of food on drug therapy and the effect of drugs on food and nutrition.

6. TOXICOLOGY AND TOXIC EFFECTS OF DRUGS

Toxicology

Introduction to toxicology and the mechanisms by which chemicals elicit adverse effects in the human body; toxicokinetic and toxicodynamic aspects and their clinical relevance. Natural toxins, animal and plant, their pathophysiological effects and treatment.

Toxic Effects of Drugs

This lecture will cover the basic definition of drug toxicity and will introduce the concept of the Therapeutic Index (TI). The causes for different individual responses to drugs (risk factors for drug toxicity) will be outlined. Major toxic reactions to common drugs including the mechanism of disease and primary treatment options will be discussed.

7. CURRENT TRENDS IN PHARMACOLOGY

This lecture will exam current and topical issues relevant to molecular pharmacology, clinical and experimental pharmacology, neuropharmacology and drug design and development. Be prepared for discussion as we look at pharmacology in the news.

TIMETABLE - INTRODUCTORY PHARMACOLOGY (PHAR2011) S2 2016

Wk	Date	Practical: WW115/116 Monday*	Lecture 1: Burrows Th Tue 1-2 pm	Lecture 2: Science Th Wednesday 1-2 pm	Tutorials Tue or Wed**
1	25/7	Orientation to Practicals (all students) Liu/Finch	Introduction to Pharmacology Liu /Finch	Sites of Drug Action: Dose Response T. Binder	
2	1/8	Concentration Response: Agonists A. Finch	Agonists and Antagonists T. Binder	Introduction to Receptors A. Finch	Essay Writing Liu / tutors
3	8/8	Concentration Response: Agonists A. Finch	Receptor Signalling A. Finch	Introduction to Autonomic Pharmacology L. Liu	Pharmacodynamics (self directed learning)
4	15/8	Concentration Response: Antagonists T. Binder	Cholinergic Mechanisms 1 L. Liu	Cholinergic Mechanisms 2 L. Liu	Receptor Signalling Finch / tutors
5	22/8	Concentration Response: Antagonists T. Binder	Adrenergic Mechanisms 1 A. Finch	Adrenergic Mechanisms 2 A. Finch	Cholinergics Liu / tutors
6	29/8	Drugs and the Eye T. Binder	Regulation of Neurotransmitters N. Jones	Drugs of Addiction T. Binder	Essay Progress / MCQexercise Liu / tutors
7	5/9	Drugs and the Eye T. Binder	TEST Liu / Binder	Autacoids L. Liu	Adrenergics Finch / tutors
8	12/9	***Drugs Alter the Brain's Reward Pathway Self-directed learning	Drug Chemistry and Absorption R. Grant	Drug Metabolism R. Grant	Test Review/Prac Qs/Peer review Liu / tutors
9	19/9		Anti-inflammatory Drugs T. Binder	Drugs and Disease: Asthma T. Binder	Peer assessments and practice Liu / tutors
Midsession break (26 Sep to 2 Oct)					
10	3/10	<u>Monday - Public Holiday</u>	Peptic Ulcer L. Liu	Alternative Medicines R. Grant	Anti-inflammation Drugs Binder / tutors
11	10/10	Drug Excretion: Aspirin Binder / Grant	Neutraceuticals R. Grant	Toxic Effects of Drugs N. Jones	Drugs & Diseases - Case Studies Liu / Binder / tutors
12	17/10	Drug Excretion: Aspirin Binder / Grant	Toxicology T. Binder	Future of Pharmacology: New drug Targets T. Binder	Drug Metabolism Grant / Binder / tutors
13	24/10				Exam Revision Quiz L. Liu / T. Binder
<p>*Practical labs: M10A: Wks 1, 2, 4, 6, 8, 12 (10am-1pm) M10B: Wks 1, 3, 5, 7, 8, 11 (10am-1pm) M14A: Wks 1, 3, 5, 7, 8,11 (2-5 pm) Please note: all students must attend Wk 1's practical lab *** "Drugs Alter the Brain's Reward Pathway" is a self-directed learning practical, which must be completed before or on 12 Sept.</p>				<p>** Tutorials: <u>Tue 2-3pm Mat 107 or Mat 123, or</u> <u>Wed 3-4 pm Mat 107 or Mat 123, or</u> <u>Wed 4-5pm Mat 107 or Mat 123</u></p>	