UNSW AUSTRALIA | Medical Sciences Medicine

DEPARTMENT OF PHARMACOLOGY

PHAR3306

PHARMACOLOGY for OPTOMETRY

COURSE OUTLINE

SEMESTER 2, 2016

CRICOS Provider Code 00098G

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PHAR3306 Course Information

UNITS OF CREDIT (UOC)

Pharmacology for Optometry is a 3rd year Science Course with 6 Units of Credit (UOC).

PREREQUISITES

VISN2111 Vision Science 2A

PHSL2101 Physiology 1A

PHSL2201 Physiology 1B

VISN2231 Introduction to Ocular Disease

OBJECTIVES OF THE COURSE

The aims of the course are to provide optometry students with

- a strong knowledge base in pharmacology and therapeutics that will benefit you in your future optometry practice
- the essential knowledge of the mechanisms of action of pharmacological agents and their therapeutic use in the treatment of systemic and ocular diseases, with emphasis on the agents that optometrists are licensed to prescribe (see Appendix I)
- basic principles of drug action, pharmacokinetics, pharmacodynamics, autonomic pharmacology, major drugs used in the management of cardiovascular, central nervous system, endocrine and inflammatory disorders and infection, drugs for eye diseases, side effects and contraindications of commonly used therapeutic agents

COURSE CO-ORDINATOR and LECTURERS

Course Coordinator:
Dr Greg Smith
Rm 326 Wallace Wurth Building East ph: 9385 8075, email: g.smith@unsw.edu.au

Students wishing to see the course coordinators should make an appointment *via* email as our offices are not readily accessible. We will organize to meet you in a convenient location elsewhere in the building.

Lecturers in this course:

Dr T. Binder	w.binder@unsw.edu.au
A. Delmadoros	a.delmadoros@unsw.edu.au
A/Prof N. Di Girolamo	n.digirolamo@unsw.edu.au
Dr R. Grant	r.grant@unsw.edu.au
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Dr N. Kumar	natasha.kumar@unsw.edu.au

Please read this manual/outline in conjunction with the following pages on the School of Medical Sciences website:
- Advice for Students
- Learning Resources

(or see "STUDENTS" tab at medicalsciences.med.unsw.edu.au)

COURSE STRUCTURE and TEACHING STRATEGIES

Learning activities occur on the following days and times:

- Lectures: Monday 2-3 pm, Wednesday 4-5 pm and Wednesday 5-6 pm
- Thursday 2-3 pm (Group A) or 3-4 pm (Group B) or 4-5 pm (Group C) (weeks 4, 6, 10)*
- Thursday 3-6 pm (all together). Weeks 2, 3, 5, 7 (exam 1), 9, 11 in G6/G7. Thursday 2-5 pm week 8 only in WW115*

  * Once enrolled in one of the two sessions, students cannot change.

Students are expected to attend all scheduled activities for their full duration (3 hours of lectures per week and up to 4 hours of practical and collaborative learning sessions per week). 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 are approximately 72 hours throughout the semester and students are expected (and strongly recommended) to do at least the same number of hours of additional study.

Lectures will provide you with the concepts and theory essential for an understanding of Pharmacology for Optometry. To assist in the development of research and analytical skills practical classes and collaborative learning sessions will be held. These classes allow students to engage in a more interactive form of learning than is possible in the lectures. The skills you will learn in practical classes are relevant to 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 and challenges students. The teaching is designed to be engaging and relevant in order to prepare students for future careers.

Although the primary source of information for this course is the lecture material, effective learning can be enhanced through self-directed use of other resources such as textbooks and Web based sources. Your practical classes will be directly related to the lectures and it is essential 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.

TEXTBOOKS AND OTHER RESOURCES

These resources will take the form of text books, journal articles or web-based resources. If available, links to the electronic form of these resources will be put on the course Moodle page.

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. (The e-book is available through UNSW Library).
- Clinical Ocular Pharmacology. 5th ed., Oxford: Butterworth-Heinemann.

Copies of these textbooks are available in the library.

National Prescribing Service (NPS) is a member-based organisation providing accurate, balanced, evidence-based information and services to health professionals and the community on Quality Use of Medicines (QUM). You are strongly encouraged to use this service: http://www.nps.org.au/

STUDENT LEARNING OUTCOMES

PHAR3306 will develop those attributes that the Faculty of Science has identified as important for a Science Graduate to attain. These include; skills, qualities, understanding and attitudes that promote lifelong learning that students should acquire during their university experience.

Graduate Attributes

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

On completion of this course students should:

1. have developed an understanding of the concepts of pharmacology
2. be able to apply pharmacological approaches to problem solving
3. be able to identify areas in the knowledge of pharmacology that could be improved, and carry out the research necessary to "fill the gaps"
4. be able to organise scientific information into a clear report
5. be able to demonstrate ability to work in teams and communicate scientific information effectively

ASSESSMENT PROCEDURES

- Midsession Exam (2 hours duration) **40%**
- Practical reports (2-short reports, 5% each) **10%**
- Group assignment **10%**
- End of session examination (2 hours duration) **40%**

A penalty will apply for late submissions of assessment tasks (10% per day).

Progress examination

The *progress examination* will be held in the laboratory slot on Thursday the 8th of September at 3 pm. This exam will give you feedback on how you are succeeding in the course. The format is 15 MCQ's and 9 x 10 min questions (from 11 questions). The end of session examination will be held during the official examination period, and the format will be 15 MCQs and 9 short 10 min questions (from 11 questions). The exam questions will mainly be based on the material covered in the lectures; however, material covered in the tutorials

and practical classes will also be examinable.

The mid and end of session examinations will address graduate attributes A, B and F and give you feedback on how you are succeeding in the course.

Practicals and tutorials

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 A, C, D, E & F. During the practical course, students will be required to submit written reports for two of the practical sessions. Reports must be legible and as concise as possible. The electronic version of the report must be submitted via Moodle **on the same day the practical session is scheduled**. No hardcopy is required. There will be a "10% mark deduction per day penalty" for late submission unless illness or family emergency is documented.

Group Assignment

You will work in teams to research new approaches/developments in ocular pharmacology and a written report to summarise your findings is required. This assessment task will allow you to develop your research, information literacy, communication and time management skills, as well as allowing you to demonstrate the ability to work in a team and collaborate successfully (Graduate attributes A, C, D, E & F). The electronic version of the assignment must be submitted **via Moodle through Turnitin**, **before 10 am, Monday, 10th October**. There will be a "10% mark deduction per day penalty" for late submission unless illness or family emergency is documented. The topics, instructions, and marking criteria for the group assignment will be handed to you during the first tutorial session in week 2.

COURSE EVALUATION AND DEVELOPMENT

Each year feedback is sought from students about the course and continual improvements are made based on this feedback. The Course and Teaching Evaluation and Improvement (CATEI) Process of UNSW is the way in which student feedback is evaluated and significant changes to the course will be communicated to subsequent cohorts of students.

GENERAL INFORMATION

The Department of Pharmacology is part of the School of Medical Sciences and is within the Faculty of Medicine. It is located in the Wallace Wurth 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 Department and appointments to meet with her may be made via email (m.morris@unsw.edu.au).

Postgraduate degrees
The Department of Pharmacology offers students the opportunity to enter into the following graduate programs:

Course Work Masters: Masters in Drug Development. For more information contact Dr Orin Chisholm (o.chisholm@unsw.edu.au)

Research Masters: In Pharmacology. For more information contact the post-graduate co-ordinator Dr Pascal Carrive (p.carrive@unsw.edu.au)

Doctorate (***Ph.D)***: In Pharmacology. For more information contact the post-graduate co-ordinator Dr Pascal Carrive (p.carrive@unsw.edu.au)

Enrolment and administrative help

Ms Carmen Robinson and Ms Justine Maguire-Scarvelli are available to help with problems with enrolment and scheduling, and should be the first point of contact for administrative problems. They can be found in the BSB Student Office, Room G27, Ground floor of the BioSciences Building. ph:9385 2464,

Email: Carmen.Robinson@unsw.edu.au; j.maguire-scarvelli@unsw.edu.au

Official Communication

All communicate will be via your official UNSW email please see Advice for Student-Official Communication for more details.

Attendance Requirements

PHAR3306 requires 80% attendance at all lectures. Attendance will be monitored and recorded.

For details on the Policy on Class Attendance and Absence see Advice for Students and the Policy on Class Attendance and Absence.

Guidelines on extra-curricular activities affecting attendance can be found on the School of Medical sciences Website. http://medicalsciences.med.unsw.edu.au/sites/default/files/Extra-curricularActivitiesSOMS.pdf

Attendance at practical classes is compulsory, and must be recorded in the class roll at the start of each class. Arrival more than 15 minutes after the start of the class will be recorded as non-attendance. It is your responsibility to ensure that the demonstrator records your attendance and no discussions will be entered into after the completion of the class. Satisfactory completion of the work set for each class is essential. It should be noted that non-attendance for other than documented medical or other serious reasons, or unsatisfactory performance, for more than 1 practical class during the session may result in an additional practical assessment exam or ineligibility to pass the course. Students who miss practical classes due to illness or for other reasons must submit a copy of medical certificates or other documentation to the course coordinator.

Practical Classes

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

Students must take due care with biological and hazardous material and make sure all equipment is left clean and functional. In the interests of safety, 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.

For more details see Advice for Students-Practical Classes

Handwriting

Please see Student Advice-handwriting.

Special Consideration

Please see UNSW-Special Consideration and Student Advice-Special Consideration

If you unavoidably miss the progress exam in PHAR3306, you must lodge an application with UNSW Student Central for special consideration. If your request for consideration is granted an alternative assessment will be organised which may take the form of a supplementary exam or increased weighting of the final exam.

Student Support Services

Details of the available student support services can be found at Student Advice-Student support services.

Appeal Procedures

Details can be found at Student-Advice-Reviews and Appeals

Academic Integrity and Plagiarism

The UNSW Student Code outlines the standard of conduct expected of students with respect to their academic integrity and plagiarism.
More details of what constitutes plagiarism can be found here

LECTURE OUTLINES

Pharmacodynamics - Sites of drug action
This lecture provides an introduction to pharmacodynamics – what the drug does to the body; topics include: receptors, affinity and efficacy, side effects, desensitisation, up and down regulation, quantitation of drug-receptor interactions, dose-response curves, ED_{50}, and spare receptors.

Pharmacodynamics - Agonist and antagonist activity
Competitive antagonism, irreversible antagonism, functional (physiological) antagonism, chemical antagonism, concept of tone, potentiation, partial agonists, quantitative response, quantal response, therapeutic ratio, indirectly acting drugs.

Autonomic nervous system - Cholinergic mechanisms
Introduction to the autonomic nervous system (ANS) and the parasympathetic nervous system (PNS). Synaptic release of acetylcholine and cholinergic transmission. Cholinergic receptor classifications and distributions.

Introduction to 3 classes of cholinergic agents: Muscarinics, Nicotinics and Anticholinesterases. Representative agents of each class, mechanisms of action, clinical uses, side effects and contraindications.

Autonomic nervous system - Adrenergic mechanisms
Catecholamines. synthesis and metabolism of catecholamines. Adrenergic receptors. α_1 adrenergic agonists and antagonists. α_2 adrenergic agonists and antagonists. β adrenergic agonists and antagonists. Indirectly acting sympathomimetic amines. Examples of use of these classes of drugs in the eye will be given throughout the lectures.

Pharmacokinetics - Drug absorption and distribution
Pharmacokinetic parameters, half-life, volume of distribution and clearance. Relationship between lipid solubility and drug absorption, distribution, excretion, drug dosage forms, advantages and disadvantages. Renal filtration, reabsorption and secretion. Renal dysfunction and elimination.

Pharmacokinetics - Drug metabolism
Pathways of metabolism of drugs including phase I and phase II metabolism. Hepatic and extrarenal metabolism, genetic polymorphisms and their effects on duration of drug action. Important pathways of ocular drug metabolism. Pharmacokinetic formulae and calculations.

Antihypertensives
Rationale for treating hypertension, the place of drug therapy, major classes of antihypertensive drugs - ACE inhibitors, calcium antagonists, diuretics, beta-blockers, alpha blockers; commonly used examples from each class; review of basic pharmacology/mechanisms of action; adverse effects and contraindications.

Autonomic control of the eye and autonomic ocular drugs
Commonly used autonomic drugs as cycloplegics, miotics, mydriatics, including parasympathomimetics: carbachol and pilocarpine; parasympatholytics: atropine, tropicamide and cyclopentolate; sympathomimetics: phenylephrine and dipivefrine; Sympatholytics: brimonidine and timolol. Mechanisms of action, side effects and contraindications.

Diuretic agents
Brief review of renal physiology. Diuretic drugs: acetazolamide, furosemide (frusemide) and loop diuretics, chlorothiazide and distal tubule acting diuretics. Potassium sparing diuretics, amiloride, triamterene and spironolactone. Actions, interactions and side effects of the diuretics will be covered, and their clinical uses.

Drugs to treat thrombosis
Review of the mechanism of thrombosis formation. The mechanism of actions of (i) anti-platelet drugs, (ii) anti-coagulation drugs and (iii) thrombolytic drugs. By the end of the lecture students should be able to (i) describe how aspirin prevents platelet activation; (ii) identify drugs which prevent thrombosis formation versus drugs which remove thrombosis (iii) describe the mechanisms of action of warfarin and heparin.

Anaesthetics
Definition of local anaesthesia. Structure activity relationships. Mode of action, metabolism. Commonly used agents. Therapeutic applications. Toxicity.

VEGF and angiogenesis in eye disease
Vascular endothelial growth factor A (VEGF-A) is a central mediator in blood vessel growth (angiogenesis) in the eye. “Wet AMD” is a particular form of age-related macular degeneration caused by abnormal growth of blood vessels under the macula. Currently available antiangiogenesis drugs for the treatment of wet AMD will be presented.

Endocrine drugs- antidiabetic drugs
Improving glycaemic control using orally active agents, incorporating mechanism of action, clinical use, side effects of the following drugs: sulphonylureas; metformin, tolbutamide, chlorpropamide, glibenclamide. Insulin sensitising agents.

Antiepileptic drugs/sedatives/hypnotics
Different types of epilepsy. Anticonvulsant drugs and how they work: clonazepam, valproate, vigabatrin, phenobarbitone, primidone, phenytoin, carbamazepine, ethosuximide, trimethadione; adverse effects on CNS, blood and other tissues. Desirable properties of sedatives and hypnotics. Mechanism of action of benzodiazepines and barbiturates. Pharmacology of benzodiazepines. Advantages of benzodiazepines over barbiturates. Zopiclone, a new hypnosedative. Indications for use.

Antidepressants
Monoamine theory of depression; pharmacology of antidepressant drugs. Tricyclic antidepressants, possible modes of action, side effects, overdose. MAO inhibitors: side effects including food interactions (hypertensive crisis) of non-specific MAO inhibitors. Specific MAO inhibitors (moclobemide). SSRI’s (fluoxetine as prototype). Li^+ for bipolar depression.

Endocrine drugs- thyroid drugs

Drugs used to treat deficiencies or overactivity in thyroid secretion: thyroxine, triiodothyronine, propylthiouracil, carbimazole, radioactive iodine, high dose iodine, ß blockers.

Drugs used to treat asthma
Treatments for asthma and associated pharmacology. Bronchial asthma, inflammatory cells and mediators, commonly used anti-asthmatic drugs [ß-adrenergic agonists, xanthines, glucocorticoids, oral steroids]. Asthma management, treatment of severe acute asthma, viral infections, novel treatments for asthma**.**

Adverse drug effects
Epidemiology, severity, most common drugs; type A reactions, dose dependent, related to usual actions of drug; type B reactions, not dose dependent, not related to usual actions of drug. Adverse ocular and systemic effects of drugs administered in eye drops. Adverse ocular effects of drugs administered orally or by injection.

Antiglaucoma drugs
Brief introduction to the pathology of glaucoma and ocular hypertension. Rationale for the use of directly acting cholinomimetics, acetylcholine esterase inhibitors, adrenergics, carbonic anhydride inhibitors, etc, in treatment. Comparison of pharmacokinetics, routes of administration, contraindications and side effects.

Anti-inflammatory drugs-NSAIDs
Gross effects, therapeutic uses (including ocular) and side effects of non-steroidal anti-inflammatory drugs. Relationships of effects of NSAIDs to inhibition of cyclooxygenase, analgesia, anti-inflammatory, antipyresis, anti-platelet effects, effects on uterus, gastrointestinal tract. Selective COX-2 inhibitors.

Anti-inflammatory drugs-steroids
Inappropriate inflammatory or immune reactions are involved in many disease processes. Antiinflammatory drugs have been either glucocorticosteroids (GCS), or non-steroidal agents (NSAIDs). The pathway of synthesis of the prostaglandins and their major actions. The gross effects (including the anti-inflammatory effects) of the GCS. Dose forms of eye drops and ointments. Additives to eye drops of GCS.

Antihistamine and mast cell stabilizers
History. Synthesis & storage. Histamine release. Metabolism. Effects of histamine with focus on allergic reaction and gastric acid secretion. The “triple response”. Histamine H_1 and H_2 receptors. Anti-histamines: actions & clinical uses. Commonly used mast cell stabilizers and how mast cell stabilizers work to prevent or control allergic disorders.

Antibiotics
Mechanisms of action of antibiotics and antimicrobial agents, including inhibitors of DNA synthesis (inhibitors of DNA gyrase and folic acid biochemistry), cell wall synthesis (inhibitors of peptido-glycan synthesis), and the various steps in protein synthesis.

Dry eyes and treatment
The tear film, functions of the tear film and tear secretion; causes and pathophysiology of dry eye; management and pharmacological treatment of dry eye.

Antiviral and antifungal agents
Pathogenic viruses, viral life cycles, virus-specific targets, DNA polymerase inhibitors, reverse transcriptase inhibitors, protease inhibitors, inhibitors of virus attachment. Pathogenic fungi, sites for chemotherapeutic intervention, antifungal antibiotics including amphoteracin and nystatin, antifungal drugs including flucytosine, azoles such as ketoconazole and clotrimazole.

Diseases of the human ocular surface

This lecture will cover the pathogenesis of common and rare diseases of the human ocular surface with particular focus on the impact of ultraviolet radiation exposure. Other topics covered will include ocular surface stem cells and techniques used to treat patients with stem cell failure.

Opioid analgesics
Historical introduction. The opioid receptors. The chemistry of the opioids: naturally occurring, semisynthetic, synthetic. Commonly used agents: morphine, codeine, pethidine, methadone, dextropropoxyphene, fentanyl, oxycodone, naloxone, bupremorphine. The assessment of analgesic activity and pain management. Adverse effects of the opioids.

Appendix I. The Use of Ocular Therapeutic Drugs in Australia[1]

Fact sheet

22 March 2013

Guidelines for use of scheduled medicines

The Optometry Board of Australia (the Board) has approved a revised version of its *Guidelines for use of scheduled medicines* (the Guidelines). The Guidelines are published under the *Policies, Codes and Guidelines* tab of the Board's website.

The amended Guidelines aim to increase quality care choices for patients living with chronic glaucoma or who are at high risk of developing the disease, particularly where access to specialist care is an issue.

Summary

The amendments to the Guidelines:

- enable optometrists whose registration is endorsed for scheduled medicines to initiate and implement management (in the form of eye drops) for patients diagnosed with chronic glaucoma, or who are at high risk of developing the disease, and
- support a multi-disciplinary team approach to managing eye conditions, including communication between other healthcare practitioners involved in the patient's care, in particular the general practitioner.

Optometrists whose registration is endorsed for scheduled medicines still have the options to either refer patients with chronic glaucoma to an ophthalmologist for ongoing care or enter into a shared care arrangement – and many optometrists are likely to continue to do so where access to specialist care is not an issue.

Optometrists are already authorised to prescribe topical glaucoma medications

Anti-glaucoma eye drops are currently an integral part of treatment for chronic glaucoma, and optometrists whose registration is endorsed for scheduled medicines are already authorised to prescribe these drugs in all states and territories.

The list of scheduled medicines that optometrists who have completed accredited training are qualified to prescribe is included in the Guidelines and in the Board's *Endorsement for scheduled medicines registration standard*. The standard is published under the *Registration Standard* tab of the Board's website.

[1] from http://www.optometryboard.gov.au/Policies-Codes-Guidelines.aspx

List of Schedule 4 medicines approved by the Optometry Board of Australia for administration by optometrists holding general registration

Under section 94 of the National Law, the Board may endorse the registration of eligible optometrists as qualified to obtain, possess, administer, prescribe or supply the scheduled medicines used in the treatment of conditions of the eye, included in the list below.

Table C1 lists the Schedule 4 medicines that have been approved for use by optometrists whose registration has been endorsed by the Board. This is a duplicate of the list published in the Board's Endorsement for scheduled medicines registration standard.

For an optometrist to possess, prescribe, supply or use these Schedule 4 medicines in a particular jurisdiction, the authorisation must be provided for by enactment of legislation in that jurisdiction. Registered optometrists should be familiar and comply with the current requirements in the jurisdictions in which they practise. The Board will publish on its website a list of authorities that apply in each state and territory.

Board-approved list of Schedule 4 poisons that optometrists with a scheduled medicines endorsement are qualified to obtain, possess, administer, prescribe or supply for topical use (reviewed by Greg Smith 2016)

Anti-infectives	**Anti-inflammatories**	**Decongestants/ anti-allergics**	**Anti-glaucomas**	**Miotics, mydriatics and cycloplegics**	**Local anaesthetics**
Aciclovir	Cyclosporin	Olopatadine	Apraclonidine	Atropine	Amethocaine
Azithromycin	Dexamethasone		Betaxolol	Cyclopentolate	Lignocaine
Bacitracin	Diclofenac		Bimatoprost	Homatropine	Oxybuprocaine
Cephazolin	Fluorometholone		Brimonidine	Pilocarpine	Proxymetacaine
Chloramphenicol	Flurbiprofen		Brinzolamide	Phenylephrine	
Ciprofloxacin	Hydrocortisone		Carbachol	Tropicamide	
Framycetin	Ketorolac		Diprivefrin		
Gentamicin	Prednisolone		Dorzolamide		
Gramicidin			Latanoprost		
Neomycin			Levobunolol		
Ofloxacin			Pilocarpine		
Polymyxin			Timolol		
Tetracycline			Travoprost		
Tobramycin					
Vidarabine					