



FACULTY OF MEDICINE

SCHOOL OF MEDICAL SCIENCES

DEPARTMENT OF PHARMACOLOGY

**PHPH 3251**

# **Clinical & Experimental Pharmacology**

COURSE OUTLINE

SESSION 1, 2009

## CONTENTS

Course Information.....	3
Assessment Procedures.....	5
Marking Criteria.....	6
Text book and Reading list.....	9
Course Evaluation & Development.....	9
General Information.....	9
Lecture and Practical Class Overview.....	15
Lecture Summaries.....	16
Timetable.....	19
Poster titles.....	20
Practicals.....	21
<i><math>\beta</math>-Blockers</i> .....	22
<i>Diuretics</i> .....	37
<i>Pain management</i> .....	46
<i>Pharmacokinetics</i> .....	56
<u>Past Exam papers.....</u>	<u>59</u>

# PHPH3251 Course Information

Clinical & Experimental Pharmacology (PHPH3251) is a 3<sup>rd</sup> year Science Course worth Six Units of Credit (6 UOC). The course is required as part of a major or minor study plan in Pharmacology for the Bachelor of Science or Bachelor of Medical Sciences. The course will build on the information you have gained in Pharmacology (PHPH2011) and Physiology (2101 & 2201) as well as Biochemistry (BIOC2101/2181)) and Molecular Biology (2201/2291) or Chemistry (2021/2041).

## OBJECTIVES OF THE COURSE

---

Building on basic pharmacology skills learned in PHPH2011, the objectives of this course are to a) introduce and develop an understanding of the use of selected formulae to predict drug concentration in, and clearance from, the human body b) provide both knowledge and conceptual understanding of the use and action of various classes of drugs in the treatment of different human diseases and c) develop an appreciation of the need for further research to identify new drug targets for more effective therapies.

## COURSE CO-ORDINATOR and LECTURERS:

---

Course Coordinator Dr Ross Grant  
Rm 203, Level 2 Wallace Wurth Building ph: 9385 3742

Consultation times: Tuesday 10-11am

Co-Coordinator Dr Trudie Binder

Rm M211B Level 2 Wallace Wurth Building ph: 9385 8737

Consultation times: Monday 3-4 pm

Students wishing to see course coordinators outside consultation times should make an appointment via email.

### Lecturers in this course:

Dr Trudie Binder

[w.binder@unsw.edu.au](mailto:w.binder@unsw.edu.au)

Prof Ric Day

[r.day@unsw.edu.au](mailto:r.day@unsw.edu.au)

Dr Angela Finch

[angela.finch@unsw.edu.au](mailto:angela.finch@unsw.edu.au)

Dr Ross Grant

[r.grant@unsw.edu.au](mailto:r.grant@unsw.edu.au)

A/Prof Renate Griffith

[r.griffith@unsw.edu.au](mailto:r.griffith@unsw.edu.au)

Dr Gilles Guillemin

[g.guillemin@cfi.unsw.edu.au](mailto:g.guillemin@cfi.unsw.edu.au)

Prof Wendy Jessup

[w.jessup@unsw.edu.au](mailto:w.jessup@unsw.edu.au)

Dr Nicole Jones

[n.jones@unsw.edu.au](mailto:n.jones@unsw.edu.au)

Dr Lu Liu

[lu.liu@unsw.edu.au](mailto:lu.liu@unsw.edu.au)

Prof Margaret Morris

[m.morris@unsw.edu.au](mailto:m.morris@unsw.edu.au)

A/Prof Larry Wakelin

[l.wakelin@unsw.edu.au](mailto:l.wakelin@unsw.edu.au)

## COURSE STRUCTURE and TEACHING STRATEGIES

---

This is a 6 unit course and consists of:

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

Learning activities occur on Monday between 10am and 1pm, Tuesdays between 1-2pm and 4-6pm and on Wednesday between 1-2 pm. Students are expected to attend all scheduled activities for their full duration. Students are reminded that UNSW recommends that a 6 units-of-credit course should involve about 150-180 hrs of study and learning activities. The formal learning activities are approximately 76 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 understanding the

mechanism of action and clinical effects of drug classes. For each disease the pathological process will be outlined in the lecture and the relevant drug targets in the disease process identified and current pharmacological treatments will be described. While lectures will focus on the mechanism of action and adverse effects of drugs currently in use, potential new therapies, drug targets and areas requiring further research for more effective therapies, will be identified and discussed.

To assist in the development of research and analytical skills practical classes and tutorials will be held. These classes and tutorials 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, challenges, and enthuses students. The teaching is designed to be relevant and engaging in order to prepare students for future careers in Pharmacology.

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.

## **STUDENT LEARNING OUTCOMES**

---

PHPH3251 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 subject students should:

1. be able to list examples of generic drugs used to treat major classes of disease.
2. be able to outline the mechanism of action of specified drug classes used to treat the major types of disease.
3. be able to communicate scientific information in a report.
4. be able to demonstrate their ability to work in teams and communicate scientific information effectively.

<b>ASSESSMENT PROCEDURES</b>	<b>Date due</b>	<b>% final mark</b>
Progress exam (40 min duration)	28 April	<b>15%</b>
Practical assessment (1 <sup>st</sup> report, $\beta$ -Blockers)	Group 1- 30 March Group 2- 6 April	<b>5%</b>
Practical assessment (2 <sup>nd</sup> report, Pharmacokinetics)	Group 1- 18 May Group 2- 25 May	<b>5%</b>
Student poster presentation	11 May	<b>10%</b>
End of session examination (2 hours duration)	TBA	<b>65%</b>

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. During the practical course you will be required to submit a written report for two of the practical sessions. Written assessment tasks must be accompanied by coversheet and a signed plagiarism form (download from: [http://medicallsciences.med.unsw.edu.au/SOMSWeb.nsf/resources/UG200601/\\$file/cover+sheet.pdf](http://medicallsciences.med.unsw.edu.au/SOMSWeb.nsf/resources/UG200601/$file/cover+sheet.pdf)) and handed in to School of Medical Sciences (SOMS) reception (G14, Wallace Wurth Building). A penalty will apply for late submissions.

#### *Student poster presentation*

Students will work in teams to research their topic for presentation as a scientific poster. The poster will be displayed during a poster presentation and viewing session. The student will be expected to answer questions relating to the topic both individually and as a group. The poster will be marked on set criteria by 3 academic/research reviewers or staff. This assessment task will allow you to develop your research, information literacy, communication and time management skills, as well as allowing you to demonstrate your ability to work in a team and collaborate successfully (Graduate attributes A, D, E & F).

The *progress examination* will be held during the session in week 7. This exam will give you feedback on how you are succeeding in the course. The *progress examination* and *end of session examination* will test not only your knowledge of drugs used to treat major classes of disease but also your ability to apply the knowledge you have acquired from multiple lectures to identifying areas of research on appropriate drug targets. This examination will be in the form of 20-25 multiple choice questions. The questions 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 exam will address graduate attributes A and B. The end of session examination will be held during the official examination period.

## MARKING CRITERIA FOR $\beta$ -BLOCKER PRAC REPORT

	<b>Exemplary (&gt;8.5)</b>	<b>Very Good (8.4-7.5)</b>	<b>Good (7.4-6.5)</b>	<b>Satisfactory (6.4-5.0)</b>	<b>Unacceptable (&lt;5.0)</b>
<b>Title and Formatting</b>  <hr/> <b>/10 x 0.5</b>	Title clearly indicates the subject matter of the paper. Name and student number and department address given. Times roman, 12 font, 1.5 line-spacing, Margins 3 cm. Word count ~ 1500	Title indicates the subject matter of the paper. Name and student number and departmental address given. Minor errors in formatting. Word count ~ 1500	Title indicates the subject matter of the paper. Name and student number and departmental address given. Errors in formatting. Word count ~ 1500	Title does not indicate the subject matter of the paper. Name and student number and departmental address given. Errors in formatting. Word count > 1500	Title, author's name and/or address not given. Formatting requirements not followed. Word count >or<1500
<b>Introduction</b> ~400 words  <hr/> <b>/10 x 2</b>	Concise and clear account of the scientific background and the rationale of the experiment. Final sentence summarises the broad conclusions of the paper	Clear account of the scientific background and the rationale of the experiment. Minor omissions or errors. Final sentence summarises the broad conclusions of the paper	A good introduction of the scientific background and the rationale of the experiment. A few factual error or omissions. Final sentence summarises the broad conclusions of the paper	Some introduction to the scientific background and the rationale of the experiment. More detail needed. Improved summary of the major finding needed.	Lacking detail of the rationale of the experiment and scientific background. Summary of the major finding not given
<b>Methods</b> ~150 words  <hr/> <b>/10 x 1</b>	Appropriate detail and referencing of methods used.	Sufficient detail and referencing of methods used. Minor details missing.	Insufficient detail and referencing of methods used. Minor errors.	Methods given but not referenced. Lacks details and has errors.	Methods not written in paragraph style.
<b>Results</b> ~300 words  <hr/> <b>/10 x 1</b>	Excellent description of the experimental results. No conclusions or interpretation of results presented. Data analysis was performed correctly	Good description of the experimental results. No conclusions or interpretation of results presented. Minor errors in data analysis.	Good description of the experimental results. Lacks some required detail. No conclusions or interpretation of results presented. A few errors or omissions in data analysis.	Description of the experimental results lacks required detail. Some conclusions or interpretation of results presented. Some errors or omissions in data analysis	No description of results. Results not written in paragraph style. Errors in data analysis. Some data analysis not presented.
<b>Figures &amp; Legends</b>  <hr/> <b>/10 x 1</b>	Graph axes labelled and units of measurement given in parentheses. Legends explain the figures in sufficient detail that they can be understood without reference to the text	Graph axes labelled and units of measurement given in parentheses. Legends explain the figures however more detail needed to be understood without reference to the text	Minor errors in graph axes labels and units of measurement. Legends explain the figures however more detail needed to be understood without reference to the text	Errors in graph axes labels and units of measurement. Legends lack the detail needed to be understood without reference to the text	Graphs missing axes labels and units.No figure legends included.
<b>Discussion &amp; Conclusion</b> ~650 words  <hr/> <b>/10 x 2.5</b>	Discussion is clear and succinct. Extensive interpretation of the results with reference to previous scientific studies. No re-statement of the results. Main conclusions conveyed in a final paragraph.	Good interpretation of the results, greater reference to previous scientific studies needed. Some re-statement of the results. Main conclusions conveyed in a final paragraph.	Some interpretation of the results, greater reference to previous scientific studies needed. Minor errors in interpretation of the results Some re-statement of the results. Conclusions conveyed in a final paragraph.	Some interpretation of the results, greater reference to previous scientific studies needed. Errors in interpretation of the results Some re-statement of the results. Some conclusions conveyed in a final paragraph.	No interpretation of the results with reference to previous scientific studies given. Results presented. Main conclusions not conveyed in a final paragraph.
<b>Referencing</b>  <hr/> <b>/10 x 1</b>	In-text citations and reference list follow BJP conventions. Relevant information selected. A wide range of references used.	In-text citations and reference list follow BJP conventions. Relevant information selected. A wider range of references needed.	In-text citations and reference list follow BJP conventions, with minor errors. Relevant information selected. A wider range of references needed.	In-text citations and/or reference do not follow BJP conventions. Relevant information selected. A wider range of references needed.	BJP conventions not followed. Non-peer review sources used. Information in intro/discussion not referenced. A wider range of references needed
<b>Writing Conventions</b>  <hr/> <b>/10 x 1</b>	Excellent sentence structure, correct grammar and word usage. Sentences and paragraphs well connected. Appropriate written expression-using discipline specific vocabulary and formal not oral language. Has been proof read.	Good sentence structure, correct grammar and word usage. Sentences and paragraphs well connected. Appropriate written expression- using discipline specific vocabulary and formal not oral language. Proof reading needed to eliminate minor errors.	Good sentence structure, correct grammar and word usage. Sentences and paragraphs not always well connected. Appropriate written expression-better use of discipline specific vocabulary and formal not oral language needed. Proof reading needed to eliminate minor errors.	Poor sentence structure, grammar and word usage. Sentences and paragraphs not well connected. Appropriate written expression-better use of discipline specific vocabulary and formal not oral language needed. Proof reading needed to eliminate errors.	Use of paragraphs and improved sentence structure needed. The report is difficult to read due to poor grammar and word usage. No evidence of proof reading.
<b>Total=</b>  <hr/> <b>/100</b>					

## **PHARMACOKINETICS PRACTICAL REPORT**

NOTE: The write up for the **Pharmacokinetics practical** will require you to answer the questions given at the end of the practical only. A formal report write-up as listed above will not be required.

---

### **MARKING CRITERIA FOR POSTER**

#### **Academic assessment**

Each Student (group) poster will be graded by up to 3 different academic/staff according to the following criteria at the scheduled 'Poster Session'. These marks will be collated by the course coordinator to provide the final grade for the poster.

The group mark will be initially assigned to each member of the group. However an individual's mark may be scaled down depending on their peer assessment (see, 'Group-members evaluation' below)

<b>Graded Categories</b>	<b>Specific criteria</b>	<b>Mark</b>
Visual presentation of information in poster	Information in poster is well organised and presented. (i.e. poster looks good; information is succinct; good use of diagrams)	15
Accuracy/relevance of Scientific and Clinical information provided in the poster	Subject information is current and covers topic adequately. Number and source of references are adequate and relevant to topic	15
<u>Group</u> - oral presentation of poster topic	As a group, students are able to give a good oral description of the poster topic.	10
<u>Group</u> and <u>Individual</u> knowledge of poster topic	All students in the group are able to demonstrate a sound knowledge of the topic presented in the poster.	10
Final Mark		50

**GROUP-MEMBERS EVALUATION (of Poster) FORM**

**Title of poster:** \_\_\_\_\_

**Name of student doing the assessment:** \_\_\_\_\_

**Instructions**

Use this form to evaluate the members of your group. Write the name of each group member, including yourself, in one of the columns, then assign a score of 0 to 10 (0 being the lowest grade, 10 the highest) to each group member for each criterion. Because each group member has different strengths and weaknesses, the scores you assign will differ. At the bottom of this sheet, write down any comments you wish to make.

- Note:
- 1) Each student in the group will complete this evaluation for each member of the group.
  - 2) Students must hand these evaluation forms to the course coordinator during the poster presentation session.
  - 3) While the overall group mark will be set by the 3 academic reviewers this group member evaluation will be used to scale marks within the group as required.

Criteria	Group Members (name)		
Regularly attends meetings			
Is prepared at the meetings			
Meets deadlines			
Contributes good ideas			
Effort given to researching subject			
Submits high-quality work			
Listens to other members			
Give constructive feedback			
Responds to constructive feedback			
Your overall assessment of this person's contribution ( /10)			

Comments:

## TEXTBOOK AND READING LIST

---

### **Recommended Primary Text**

Brunton, Parker, Blumenthal, Buxton. Goodman & Gilman's Manual of Pharmacology and Therapeutics. McGraw-Hill 2008

### **Recommended Secondary Text**

Rang, Dale, Ritter and Flower; Pharmacology 6<sup>th</sup> ed. Churchill Livingstone, 2007

### **Other relevant texts**

Katzung; Basic & Clinical Pharmacology, 10<sup>th</sup> ed. McGraw-Hill, 2007

Hardman, Limbird, Molinoff, Ruddon, Gilman. Goodman & Gilman's The Pharmacological basis of therapeutics 10<sup>th</sup> ed. McGraw-Hill

Waller, Renwick Hillier Medical Pharmacology and Therapeutics. 2<sup>nd</sup> ed. Elsevier, Saunders, 2005.

Koda-Kimble et al., Applied Therapeutics (The Clinical use of Drugs) 9<sup>th</sup> ed., Lippincott Williams & Wilkins Pty Ltd, 2009

Additional articles of interest will be placed on the course pages on WebCT Vista

## COURSE EVALUATION AND DEVELOPMENT

---

Each year feedback is sought from students about the courses offered in the Department of Pharmacology and continual improvements are made based on this feedback. The Course and Teaching Evaluation and Improvement [CATEI] Process of the UNSW is the way in which student feedback is evaluated and significant changes to the course will be communicated to subsequent cohorts of students. Also a student feedback forum will be set up and students will be invited to become class representatives to seek feedback from their colleagues and meet with academic staff to discuss any issues that arise.

Based on feedback from students in 2008 this year the Pain practical session has been modified to require more inductive reasoning in the clinical assessment task.

## GENERAL INFORMATION

---

The Department of Pharmacology is part of the School of Medical Sciences and is within the Faculty of Medicine. It is located on the 2<sup>nd</sup> floor of the Wallace Wurth building. General inquiries can be made at the School of Medical Sciences (SOMS) Reception, located on the Ground Floor of the Wallace Wurth (office hours are 9.00 am - 5:00pm).

**Professor Margaret Morris** is Head of Department and appointments may be made via email: [m.morris@unsw.edu.au](mailto:m.morris@unsw.edu.au).

**There is an honours program conducted by the School.** The Honours program is co-ordinated by Dr Angela Finch Room M207 (ph: 9385 1325). Any students considering an Honours year should discuss the requirements with the co-ordinator. Outstanding students may be considered for scholarships offered by the University and School and these are offered annually.

### **Postgraduate research degrees**

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

**Doctorate (Ph.D):** In Pharmacology. For further information contact the co-ordinator, Pascal Carive [p.carrive@unsw.edu.au](mailto:p.carrive@unsw.edu.au)

**Masters Degrees:** Students can enrol in a Masters in Drug Development [For further information contact Dr John Langlands; [email: [j.langlands@unsw.edu.au](mailto:j.langlands@unsw.edu.au)] or a Master of Science in Biopharmaceuticals [Contact Dr Chris Marquis; email [c.marquis@unsw.edu.au](mailto:c.marquis@unsw.edu.au) or A/Prof Wakelin; email [L.Wakelin@unsw.edu.au](mailto:L.Wakelin@unsw.edu.au)].

**Departmental Vacation Scholarships:** The Department of Pharmacology supports several summer vacation scholarships each year to enable good students to undertake short research projects within the department. For further details contact the Administrative Officer. **The School Student Advisor** Ms Carmen Robinson (9385 2464) is able to provide additional information on any courses offered by the School. Email: Carmen.robinson@unsw.edu.au

## **OFFICIAL COMMUNICATION BY EMAIL**

---

All students in the course PPH3251 are advised that e-mail is the official means by which the School of Medical Sciences at UNSW will communicate with you. All e-mail messages will be sent to your official UNSW e-mail address (e.g. z1234567@student.unsw.edu.au) and, if you do not wish to use the University e-mail system, you **MUST** arrange for your official mail to be forwarded to your chosen address. The University recommends that you check your mail at least every other day. Facilities for checking e-mail are available in the School of Medical Sciences and in the University library. Further information and assistance is available from DIS-Connect, ph. 9385 1777. Free e-mail courses are run by the UNSW Library.

*Email etiquette: All email communication should be in formal English; students should provide their name, student number and course code. Please allow 3 working days for a response*

## **ATTENDANCE REQUIREMENTS**

---

**Attendance at practical classes/demonstrations is compulsory, and must be recorded in the class roll ON THE DAY OF THE CLASS.**

**Students will be marked absent if they arrive more than 15 minutes after the scheduled start time of the class.** 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.

## **BEHAVIOUR IN PRACTICAL CLASSES**

---

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

- Punctual arrival is expected.
- Turn-off mobile phones before entering the class. (mobile phones must not be used or answered during the class)
- A lab coat must be worn to all 'wet' practical classes (i.e.  $\beta$ -blocker, Diuretics)
- Enclosed shoes are compulsory.

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.

## **PRACTICAL CLASSES**

---

Students are required to familiarise themselves with the experimental procedure, as recorded in the practical manual, before attending each class.

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.

## **NOTICEBOARDS**

---

Noticeboards for this course can be found on the 2nd floor of the Wallace Wurth building. Current timetables and information relevant to you will be displayed here. It is your responsibility to check these regularly.

## **COMPUTING FACILITIES**

---

Computer facilities may be available to students in rooms G2/G4 and 102/104. Your student card will allow you to operate the security lock on the door. Hours of access are 8:30am - 6:00pm. However, priority is given to scheduled classes and meetings.

NB: The School would like to advise you that a record is kept of students entering the computer facility. Students will be held responsible for any damage.

## **Teaching Resources on the Department of Pharmacology's WWW Site**

---

The Department of Pharmacology has chosen to use the University's central WebCT-vista service to provide teaching material for all of its courses. To access these materials point your browser to the School's home page at:

<http://medicalsciences.med.unsw.edu.au/SOMSWeb.nsf/page/home>

then select "Current Students" from the menu bar and click on WebCT, under "Quicklinks" in the left column.

You will need to click through the "UNSW" at the left, then click the "Log on" button and enter your Unipass credentials (zStudentNo. and password).

After logging on to WebCT, look for the course PHPH3251. You should have access to it if you are properly enrolled.

Browser Settings which are needed for WebCT:

The central WebCT service uses WebCT Vista. This makes extensive use of "pop-up" windows. Most browsers now block such pop-ups so you will need to allow pop-ups on this site for it to work properly for you.

The central WebCT service recommends the use of the "Firefox" browser when accessing WebCT. This will probably not be necessary in order to make use of the site for courses provided by the Dept. of Physiology & Pharmacology. The features of WebCT Vista which don't work well in Internet Explorer are not used in our courses.

You can make use of iletecture recordings taken of the lectures which are available on WebCT. Lecture notes will also be made available on WebCT either before or shortly after the lecture.

## **HANDWRITING**

---

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

## **SPECIAL CONSIDERATION**

---

**Please note the following Statement regarding Special Consideration.**

*If you believe that your performance in a course, either during session or in an examination, has been adversely affected by sickness or for any other reason, you should notify the Registrar and ask for special consideration in the determination of your results. Such requests should be made as soon as practicable after the problem occurs. **Applications made more than three days after an examination in a course will only be considered in exceptional circumstances.***

*When submitting a request for special consideration you should provide all possible supporting evidence (e.g. medical certificates) together with your registration number and enrolment details. Consideration request forms are available from the Student Centre in the Chancellery and from Course Offices. In exceptional circumstances further assessment may be given. **If you believe you might be eligible for further assessment on these grounds, you should contact the Course Authority or the relevant Course Office as soon as possible.***

Please refer to UNSW Student Gateway @ [www.student.unsw.edu.au](http://www.student.unsw.edu.au) for further details regarding special consideration.

## **MISSED EXAMS**

---

If in any circumstances you unavoidably miss an examination, you must inform the Registrar and also contact the relevant Course Office immediately. Normally, if you miss an exam (without medical 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.

**PLEASE NOTE** that if you miss any examinations for medical reasons you must lodge a medical certificate with New South Q within **3 DAYS** (refer to UNSW Student Gateway @ [www.student.unsw.edu.au](http://www.student.unsw.edu.au) for further details).

Your request for consideration will be assessed and a deferred exam may be granted. You cannot assume you will be granted supplementary assessment. The deferred exam may include a significant oral element. The supplementary exam will be held in the week starting 6<sup>th</sup> July.

## **MISSED TESTS**

---

If you unavoidably miss a test in PHPH3251, you must inform the course coordinator **Dr Ross Grant in Lab/office 203** immediately. You must supply adequate documentation (medical certificate) to be considered for any supplementary tests. **Such tests may consist of an oral or written examination that may be held during the first week of the stuvac period.**

## **MEDICAL CERTIFICATES**

---

Students who miss practical classes due to illness or for other reasons must submit a copy of

medical certificates or other acceptable documentation to the course co-ordinator. Certificates should be lodged no more than 7 days after an absence. Certificates lodged after 7 days will not be accepted. The following details must be attached: Name, Subject number, Group number, Date of the class, Name of class/es missed.

## **REPEATING STUDENTS**

---

Practical class exemptions may be granted to repeat students but students **must** check with the course co-ordinator whether they have exemption **prior** to their first practical class. All students must be familiar with the material covered in the practical classes.

## **STUDENT SUPPORT SERVICES**

---

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (**EADU**) **9385 4734**. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

## **STUDENT RIGHTS AND RESPONSIBILITIES**

---

Refer to UNSW Student Gateway @ [www.student.unsw.edu.au](http://www.student.unsw.edu.au)

## **PLAGIARISM**

---

The School of Medical Sciences will not tolerate plagiarism in submitted written work. The University regards this as academic misconduct. Evidence of plagiarism in submitted assignments, etc. will be thoroughly investigated and may be penalised by the award of a score of zero for the assessable work. Evidence of plagiarism may result in a record being made in the Central Plagiarism Register and the Faculty Students Ethics Officer being notified.

### **What is Plagiarism?**

Plagiarism is the presentation of the thoughts or work of another as one's own.\* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

<http://www.lc.unsw.edu.au/plagiarism/>

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

\* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle

† Adapted with permission from the University of Melbourne.

## **APPEAL PROCEDURES**

---

Refer to UNSW Student Gateway @ [www.student.unsw.edu.au](http://www.student.unsw.edu.au).

## **GRIEVANCE RESOLUTION OFFICER**

---

In case you have any problems or grievance about the course, you should try to resolve it with the Course Coordinator (Dr Ross Grant ph:9385 3742) or the Head of Department, Prof Margaret Morris, 9385 1560. If the grievance cannot be resolved in this way, you should contact the School of Medical Sciences Grievance Officer, Dr P.Pandey (9385 2483, [P.Pandey@unsw.edu.au](mailto:P.Pandey@unsw.edu.au)).

## LECTURE AND PRACTICAL CLASS OVERVIEW

---

The course timetable is appended at the end of these notes and can also be found on WebCT vista.

The course is divided into 4 main themes covering the major diseases and therapeutics;

1. Predicting drug concentrations in the body (pharmacokinetics)
2. Drugs affecting diseases and disorders of major systemic organ systems
3. Infection and antimicrobial drugs
4. Cancer chemotherapy

### **1. Predicting drug concentrations in the body (pharmacokinetics)**

#### *Lectures*

Pharmacokinetics (1 & 2)

Toxic effects of drugs

#### *Tutorials*

Pharmacokinetics

#### *Practicals*

Pharmacokinetics

### **2. Drugs affecting diseases and disorders of the major systemic organ systems**

#### *Lectures*

Cardiac failure drugs

Antihypertensives

Renal Pharmacology

Lipid lowering drugs

Haemostasis and Thrombosis

Endocrine pharmacology 1&2

Reproductive Pharmacology

Therapeutics of the G.I.T.

Antiarthritic drugs

Respiratory Pharmacology

Immunopharmacology

#### *Tutorials*

Diuretic prac - follow-up tutorial

Autonomic ( $\beta$ blocker) prac - follow-up tutorial

#### *Practicals*

$\beta$ -Blocker-effect on heart rate

Diuretic Pharmacotherapy

Pain management

### **3. Infection and antimicrobial drugs**

#### *Lectures*

Antimicrobial chemotherapy 1&2

Antiviral chemotherapy

### **4. Cancer Chemotherapy**

#### *Lectures*

Anticancer drugs 1&2

#### *Tutorials*

Anticancer drugs

### **Anti-Hypertensive Drugs**

Definition of hypertension, primary (essential) and secondary hypertension, consequences of untreated hypertension, guidelines for treating hypertension, non-pharmacological treatment including lifestyle issues, pharmacological treatment including ACE inhibitors, angiotensin 2 receptor blocking agents, diuretics, calcium channel blocking agents and beta receptor blocking agents

### **Cardiac Failure**

Types of heart failure, causes of heart failure, signs and symptoms of heart failure, pathophysiological changes, non-pharmacological treatment, pharmacological treatment including ACE inhibitors, angiotensin 2 receptor blocking agents, diuretics, beta receptor blocking agents, spironolactone and digoxin

### **Renal Pharmacology**

This lecture will outline the role played by the kidney in the development of oedema and hypertension. The mechanism of action of important drug classes that act on the kidney will be outlined and their relative merits in controlling disease will be discussed within the clinical context.

### **Haemostasis and Thrombosis drugs**

This lecture will review the fundamentals of blood coagulation emphasizing primary elements that underlie hemorrhagic and thrombotic disease. Using this as a foundation the lecture will then discuss the role and mechanism-of-action of the anticoagulant, anti platelet and thrombolytic drugs currently used in clinical medicine. Limitations of current anticoagulant and thrombotic therapy and possible new drug targets will then be discussed.

### **Lipid lowering drugs**

Dyslipidaemia is considered a primary contributor to the development of atherosclerosis leading to heart disease. This lecture will outline briefly the pathogenesis of atheroma and the process of lipid transport before discussing the mechanism of action of the major classess of lipid lowering drugs. Limitations of current lipid therapies will be discussed with an emphasis on possible areas of new drug targets.

### **Endocrine 1& 2**

After a brief overview of endocrine function, major issues regarding treatment of endocrine disorders will be addressed. The lecture will focus on two common endocrine disorders, thyroid disease and diabetes. Their epidemiology and rationale for treatment will be discussed, including the adverse effects of therapy. The need for ongoing monitoring of therapy will be highlighted.

### **Reproductive Pharmacology**

This lecture will review the physiological actions of estrogens, progestins and androgens. The molecular basis of their actions at nuclear receptors will be discussed. The clinical uses of these hormones and antagonists of their receptors in contraception, hormone replacement therapy, prostate cancer and benign prostate

hypertrophy will be addressed. The treatment of erectile dysfunction will also be covered

### **Immunopharmacology**

This lecture will provide a brief overview of key immunocompetent cells and chemical mediators associated with acute and chronic inflammation such as histamine, prostanoids, thromboxanes, leukotrienes and kinins. The development of drugs for limiting graft Vs host disease and treating diseases which involve inflammation such as rheumatoid arthritis will be discussed. Possible drug targets for the treatment of conditions where there is currently no adequate therapy will be highlighted.

### **Opioids in pain management:**

This lecture encompasses: analgesic agents; historical introduction to the use of opioids, *Papaver somniferum* and opium; mode of action; the opioid receptors; the endogenous opioids; assessment of analgesic activity, pain measurement and pain control; adverse effects; commonly used opioids including, morphine, codeine, pethidine, methadone, heroin, fentanyl, oxycodone, naloxone, and buprenorphine; tolerance, dependence and opioid kinetics.

### **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.

**Pharmacokinetics 1&2:** These lectures will provide an introduction to the calculation of major pharmacokinetic parameters based on either single or 2 compartment modelling. Parameters covered include; half-life, volume of distribution, clearance, dosing rate, maintenance dose and bioavailability. Numerical examples will be given. The accumulation of drugs and fluctuations in plasma levels during long term drug treatment will be discussed.

### **Respiratory Pharmacology**

This lecture builds upon the concepts encountered in Introductory Pharmacology 'The Pharmacology of asthma'. The lecture will focus on chronic airway limitation, a disease state characterized by airflow limitation that is not fully reversible (unlike asthma) leading to chronic bronchitis's and emphysema. The lecture encompasses bronchodilators, anti-inflammatory drugs, antitussives and respiratory stimulants (analeptic drugs).

### **Antiinflammatory/Antiarthritic drugs**

This lecture will provide a brief overview of the use of pharmacotherapy in the two types of arthritis broadly classified as inflammatory and non-inflammatory arthritis. The objective of drug therapy in these conditions is for symptom control (pain, stiffness, loss of function) and suppression of disease activity in order to prevent long-term damage. The mechanisms of pain, inflammation and joint damage and the pharmacological approaches to dealing with these will be presented.

### **Therapeutics of the G.I.T.**

The gastrointestinal tract (G.I.T.) is a complex organ system that, in addition to its digestive capability, possesses an extensive neuronal network and major endocrine

functions. A wide range of pathologies affect the G.I.T. and contribute significantly to morbidity within the society. This lecture will discuss the rationale for therapy and the mechanism of action of current drugs affecting gastric secretion and motility and will highlight limitations of current therapy and possible new areas for drug targets.

### **Serotonin-migraine**

Sources of serotonin. Synthesis and metabolism. Agonists and antagonists at 5-HT<sub>1</sub>, 5-HT<sub>2</sub>, and 5-HT<sub>3</sub> receptors. Effects and role of 5-HT on gastrointestinal tract, bronchial smooth muscle, cardiovascular system, platelets, peripheral and central nervous system. Use of serotonergic drugs in chemotherapy and the treatment for depression, migraine and the carcinoid syndrome.

### **Anti Cancer Drugs 1&2**

Cancer biology including epidemiology, incidence and mortality, tumour genetics, apoptosis, metastasis, tumour vasculature, approaches to cancer treatment, reasons for treatment failure, mechanisms of cancer drug resistance, cancer drug classes including antimetabolites, hormones, hormone antagonists, mitotic spindle inhibitors and DNA-binding agents.

### **Antibacterials 1&2**

Lecture 1 covers antibiotic resistance mechanisms and drugs that target DNA biochemistry, including dihydropteroate synthase inhibitors, dihydrofolate reductase inhibitors, and DNA gyrase inhibitors. Lecture 2 addresses cell wall biochemistry and inhibitors of cell wall synthesis (penicillins, cephalosporins, vancomycin), and protein biosynthesis and inhibitors of ribosome function (tetracyclines, aminoglycosides, macrolides).

### **Anti Viral Pharmacotherapy**

A brief overview will be given on viruses and their classification. The infectious process for a virus will be discussed and the biochemical targets for antiviral therapy developed from that discussion, using the Human Immunodeficiency Virus (HIV) as the main example. The major antiviral drug classes will be presented, as well as treatment limitations and failures, highlighting the need for the development of new agents

### **Introduction to CNS Pharmacology**

This lecture will provide an introduction to neuropharmacology - the study of drugs that affect the brain. The lecture will briefly review the way that nerve cells communicate to each other via chemicals and receptors and will then give an overview of the variety of different chemicals and receptors utilized and the nerve pathways and neuronal functions associated with different neurotransmitter systems.

## Clinical and Experimental Pharmacology PPH3251 S1, 2009

<b>Wk</b>	<b>Date Week beginning</b>	<b>Prac. Lab. WW 202 Monday 10-1</b>	<b>Lecture 1 Biomed D Tuesday 1-2</b>	<b>Tutorial Biomed B Tuesday 4-6</b>	<b>Lecture 2 Biomed B Wednesday 12-1</b>
1	9 March		<b>INTRODUCTION</b> R. Grant		<b>Anti Hypertensive drugs</b> M.Morris
2	16 March	<b>β-Blocker prac (g1)</b> A. Finch/L.Liu	<b>Cardiac failure - drugs</b> M.Morris		<b>Renal Pharmacology</b> R. Grant
3	23 March	<b>β-Blocker prac (g2)</b> A. Finch/L.Liu	<b>Haemostasis and Thrombosis</b> A. Finch	<b>β-Blocker Tut (g1)</b> <b>G2/G4 (5-6pm)</b> A. Finch	<b>Lipid lowering Drugs</b> W. Jessup
4	30 March	<b>Diuretic prac (g1)</b> R.Grant/L.Ulman	<b>Endocrine Pharmacology 1</b> M. Morris	<b>β-Blocker Tut (g2)</b> <b>G2/G4 (4-5pm)</b> A. Finch	<b>Endocrine Pharmacology 2</b> M.Morris
5	6 April	<b>Diuretic prac (g2)</b> R.Grant/L.Ulman	<b>Reproductive Pharmacology</b> A. Finch	<b>Diuretic- Tut (g1)</b> R. Grant	<b>Immunopharmacology</b> G.Guillemin
<b>Easter Break (Friday 10 April – Sunday 19 April)</b>					
6	20 April	<b>Poster Preparation (all studs)</b> <i>(WW 202/204)</i> R. Grant	<b>Pharmacokinetics 1</b> R. Grant	<b>Diuretic- Tut (g2)</b> R. Grant	<b>Pharmacokinetics -2</b> R.Grant
7	27 April	<b>Pharmacokinetics prac (g1)</b> R. Grant/T.Binder	<b>Toxic effects of drugs</b> N. Jones	<b>Mid session TEST</b>	<b>Opioids in pain management</b> T. Binder
8	4 May	<b>Pharmacokinetics prac(g2)</b> R. Grant/T.Binder	<b>Antiinflamm/Antiarthritic drugs</b> <b>R.Day</b>	<b>Mid session Test feedback</b> <b>(stats etc)</b>	<b>Respiratory Pharmacology</b> T. binder
9	11 May	<b>Poster Presentations</b> <b>All staff</b> <i>(WW 202-204)</i>	<b>Therapeutics of the G.I.T.</b> L. Liu	<b>Pharmacokinetics Tut (g1)</b> R. Grant (Grp 1)	<b>Serotonin-migraine</b> L. Liu
10	18 May	<b>Pain. Pharm (g1)</b> R. Grant/T.Binder	<b>Anti-Cancer Drugs 1</b> L. Wakelin	<b>Pharmacokinetics Tut (g2)</b> R. Grant (Grp 1)	<b>Anti-Cancer Drugs 2</b> L. Wakelin
11	25 May	<b>Pain. Pharm (g2)</b> R. Grant/T.Binder	<b>Antimicrobials 1</b> L. Wakelin	<b>Anti Cancer Tut</b> L.W. (Group 1 & 2)	<b>Antimicrobials 2</b> L. Wakelin
12	1 June		<b>Anti viral chemotherapy</b> Renate	<b>Exam Revision Tut</b> Groups 1 & 2	<b>Introduction to CNS Pharmacology</b> R. Grant

Inquiries to Dr Ross Grant, 203, Phone: 93853742; email: [r.grant@unsw.edu.au](mailto:r.grant@unsw.edu.au)

## POSTER TITLES - 2009

Posters will be prepared by a group of up to 5 students and will be presented for marking (by 3 reviewers) at the poster session on the 11<sup>th</sup> of May. The poster presentation will be graded on scientific content, visual communication and verbal presentation.

*All members of the group will be required to participate in the presentation.*

Poster Title	Academic contact
<b>Pharmacological treatment of obesity - why and how?</b>	Prof. M. Morris <a href="mailto:m.morris@unsw.edu.au">m.morris@unsw.edu.au</a>
<b>Use of angiotensin related drugs in Insulin resistance</b>	Prof. M. Morris <a href="mailto:m.morris@unsw.edu.au">m.morris@unsw.edu.au</a>
<b>Angiogenesis as a cancer drug target.</b>	A/Prof. Larry Wakelin, <a href="mailto:L.Wakelin@unsw.edu.au">L.Wakelin@unsw.edu.au</a>
<b>Current and new drug therapies for the treatment of tuberculosis (T.B.)</b>	A/Prof. Larry Wakelin, <a href="mailto:L.Wakelin@unsw.edu.au">L.Wakelin@unsw.edu.au</a>
<b>The treatment of HIV1/ AIDS.</b>	A/Prof. Renate Griffith <a href="mailto:r.griffith@unsw.edu.au">r.griffith@unsw.edu.au</a>
<b>The effects of aging on pharmacokinetic responses</b>	Dr. Ross Grant, <a href="mailto:R.Grant@unsw.edu.au">R.Grant@unsw.edu.au</a>
<b>Uptake inhibitors and the pharmacology of depression.</b>	Dr. Ross Grant, <a href="mailto:R.Grant@unsw.edu.au">R.Grant@unsw.edu.au</a>
<b>Is Frusemide an effective pharmacotherapy to prevent or treat acute renal failure?</b>	Dr. Ross Grant, <a href="mailto:R.Grant@unsw.edu.au">R.Grant@unsw.edu.au</a>
<b>Pharmacological Management of Chronic Airway Limitation (CAL)</b>	Dr Trudie Binder, <a href="mailto:W.Binder@unsw.edu.au">W.Binder@unsw.edu.au</a>
<b>Drug addiction and the 'reward pathway'</b>	Dr Trudie Binder, <a href="mailto:W.Binder@unsw.edu.au">W.Binder@unsw.edu.au</a>
<b>Adverse effects of drugs on human foetal development</b>	Dr Nicole Jones <a href="mailto:n.jones@unsw.edu.au">n.jones@unsw.edu.au</a>
<b>New treatments of thrombosis derived from snake venoms</b>	Dr Angela Finch <a href="mailto:a.finch@unsw.edu.au">a.finch@unsw.edu.au</a>
<b>Male hormonal contraception</b>	Dr Angela Finch <a href="mailto:a.finch@unsw.edu.au">a.finch@unsw.edu.au</a>
<b>Is monitoring the plasma concentrations of gentamicin useful?</b>	Prof. Garry Graham, <a href="mailto:g.graham@unsw.edu.au">g.graham@unsw.edu.au</a>
<b>How does metformin lower blood glucose?</b>	Prof. Garry Graham, <a href="mailto:g.graham@unsw.edu.au">g.graham@unsw.edu.au</a>
<b>Triptans for migraine headache: treatment advantages and limitations</b>	Dr Lu Liu <a href="mailto:l.liu@unsw.edu.au">l.liu@unsw.edu.au</a>
<b>Are corticotrophin releasing hormone receptors a good therapeutic target for irritable bowel syndrome?</b>	Dr Lu Liu <a href="mailto:l.liu@unsw.edu.au">l.liu@unsw.edu.au</a>
<b>Non-steroidal treatments for allergy – benefits and limitations</b>	Dr John Langlands <a href="mailto:j.langlands@unsw.edu.au">j.langlands@unsw.edu.au</a>

## Practical Classes

<i>β-Blockers</i> .....	22
<i>Diuretics</i> .....	37
<i>Pain management</i> .....	46
<i>Pharmacokinetics</i> .....	56

# **Practical Class**

**THE EFFECTS OF  $\beta$ -ADRENOCEPTOR ANTAGONISTS ON  
EXERCISE INDUCED CARDIOVASCULAR CHANGES**

**PHPH3251**

**Session 1, 2009**

## THE EFFECTS OF $\beta$ -ADRENOCEPTOR ANTAGONISTS ON EXERCISE INDUCED CARDIOVASCULAR CHANGES

### Aim

To examine the effects of the widely prescribed, orally administered  $\beta$ -adrenoceptor antagonists, atenolol and pindolol, on blood pressure, heart rate and lung function at rest and after exercise.

### Introduction

$\beta$ -adrenoceptor antagonists are commonly prescribed to treat elevated blood pressure. Atenolol is a selective  $\beta_1$ -adrenoceptor antagonist and has no intrinsic sympathomimetic activity. In contrast, pindolol is a non-selective  $\beta$ -adrenoceptor antagonist which has intrinsic sympathomimetic activity (Table 1). Their effects on cardiac function will be studied under two conditions: at rest, and during a period of exercise. A therapeutically effective dose of each drug will be used and the trial will be conducted "double blind" with a placebo (vitamin B6) control. The identity of the drug/placebo will be revealed at the end of the class.

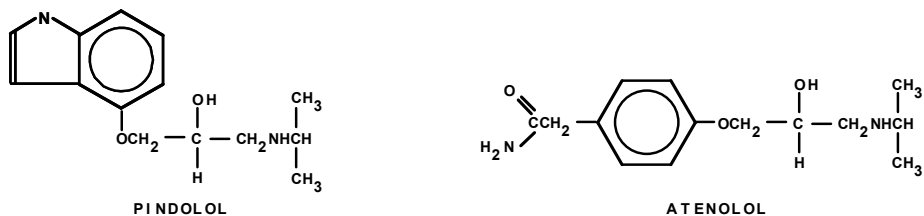


Figure 1. Chemical structures of pindolol and atenolol

**Table 1: Properties of some  $\beta$ -adrenoceptor antagonists**

	Approximate relative potency*	Antagonistic selectivity	Agonist activity**
Oxprenolol	0.5-1	non-selective	++
Pindolol	5	non-selective	+
Propranolol	1	non-selective	0
Timolol	6	non-selective	0
Atenolol	1	$\beta_1$	0
Metoprolol	1	$\beta_1$	0
Practolol	0.3	$\beta_1$	+

\* relative to propranolol, which = 1; \*\* intrinsic sympathomimetic activity

# **SAFETY INSTRUCTIONS**

**for**

<p><b>THE EFFECTS OF <math>\beta</math>-ADRENOCEPTOR ANTAGONISTS ON EXERCISE INDUCED CARDIOVASCULAR CHANGES</b></p>
---

As you will be exercising during this practical, you will need to wear appropriate clothing and shoes and have something to eat prior to coming to class.

The subjects should be healthy. Any student with a history of respiratory, cardiovascular or kidney disorders, allergies, diabetes, metabolic disease or who is pregnant or breastfeeding should seek advice as to their suitability as an experimental subject.

Subjects should minimize exercise on the day.

Once you have taken the drug, do not leave the class without notifying a demonstrator.

All participating students will be asked to complete a consent form.

## **PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM**

**THE UNIVERSITY OF  
NEW SOUTH WALES**



**SCHOOL OF MEDICAL SCIENCES**

**APPROVAL No:** HREC06025

### **Practical class – The effects of $\beta$ -adrenoceptor antagonists on exercise induced cardiovascular changes**

As an enrolled student you are invited to participate as a subject in a class that will help to develop your understanding of the pharmacology of  $\beta$ -adrenoceptor antagonists. Participation as a subject will entail your ingestion of either Atenolol (50 mg) OR Pindolol (10 mg) OR a placebo (Vitamin B6 10mg). You will not know the identity of the drug that you will consume as this is a single blind study but you will be told at the completion of the class. As a subject in this practical class, you will ingest this drug in the first 30 minutes of the class and you are invited to volunteer for the whole class which will last for 3-4 hours.

$\beta$ -adrenoceptor antagonists are safe and widely used drugs in the treatment of elevated blood pressure. As with any medication there is the potential for adverse reaction. However, provided exclusion criteria are adhered to and with the exception of anaphylaxis which is rare, adverse events are extremely unlikely after a single dose as used in this practical session. Any student with a history of respiratory, cardiovascular or kidney disorders, allergies, diabetes, metabolic disease or who is pregnant, or breastfeeding may be excluded from participating as a subject in this class. Fatigue, dizziness, trembling, laboured breathing and headaches are possible side effects and may occasionally occur after ingestion of a single dose. Long term dosage with  $\beta$ -adrenoceptor antagonists may be associated with various skin rashes and conjunctival xerosis has been reported. A transitory affect on the lipid profile may occur (increased triglycerides). The effect appears to be less for drugs with intrinsic sympathomimetic activity e.g. Pindolol. Gastrointestinal disturbances including indigestion, constipation, and dry mouth have also been reported. Biochemical abnormalities such as increases in aspartate amino transferase (AST), blood urea and serum creatinine have been reported with long term use. Vitamin B6 at high doses (> 500 mg) may cause sensory neuropathy. The dose (10 mg) used in this practical exercise is well within the recommended therapeutic dosage for this vitamin.

A registered medical doctor (from the staff in The School of Medical Sciences) will be in attendance to advise students with regards to any medical conditions or concurrent medications that may affect their participation as a subject.

Unidentified group data from this class will be shared with the rest of the class. Attendance sheets, consent forms and incident reports will be kept for a period of 7 years. Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without prejudice. If you have any questions, please feel free to ask any demonstrator on this class. If you have any additional questions later, Dr Angela Finch, ([angela.finch@unsw.edu.au](mailto:angela.finch@unsw.edu.au)), will be happy to answer them.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, Sydney 2052 Australia (phone 9385 4234, fax 9385 6648, email [ethics.sec@unsw.edu.au](mailto:ethics.sec@unsw.edu.au) ). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

**PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)**

**APPROVAL No:** HREC06025

**THE UNIVERSITY OF  
NEW SOUTH WALES**



**SCHOOL OF MEDICAL SCIENCES**

**Practical class – The effects of  $\beta$ -adrenoceptor antagonists  
on exercise induced cardiovascular changes**

I understand that I am making a decision as to whether or not to participate as a subject for the above practical class. My signature indicates that, having read the Participant Information Statement, and the practical notes which explain the full procedure, I have decided to take part in the study.

I understand that if I have any questions relating to my participation as an experimental subject in this practical class I may ask the demonstrator in charge of the class who will be happy to answer them. I understand that my participation as a subject is voluntary and that I can withdraw from being a subject at any time without prejudice to my relationship with the University of New South Wales.

<b>Subjects' name</b>	<b>Signature</b>	<b>Treatment</b>	<b>Initials</b>

Witnessed by .....

Date .....

Please PRINT Name of witness  
.....

## **Protocol**

*Note: Read the practical notes carefully before starting the experiment.*

1. Students should work in groups of 5. Each group will have 3 subjects and 2 experimenters. Each subject will have one experimenter measuring their resting parameters and one experimenter measuring their exercise parameters.
2. At the start of the class the subjects will go over the exclusion criteria and consent form with a medical practitioner and sign the consent form.
3. Before taking the drugs, measure the subject's heart rate, blood pressure and peak expiratory flow rate at rest every 15 min for the first 30 min. During this period of 30 min the subject will also exercise for two minutes at the 0, and 30 minute time points. The heart rate and fatigue measurements will be taken immediately after exercise at these times and recorded in Table 2.
4. Students should present to the dispensing area and initial the consent form. Students acting as subjects will take: placebo (B6 10 mg), OR Atenolol (50 mg) OR Pindolol (10 mg). As this is a blinded study these will be labelled as treatment 1, 2 and 3. Subjects in each group will take: Treatment 1 or Treatment 2 or Treatment 3  
  
The identity of the treatment will be revealed at the completion of the class.
5. Subjects will be required to take the tablet immediately after the 30 pre-treatment measurement period. Continue taking heart rate, blood pressure and peak expiratory flow rate measurements at rest (every 15 min) and heart rate and fatigue measurements post-exercise (every 30 min) record the data in Table 3.

## **Measurements at rest**

The subject should be seated and rested for 5-10 minutes before readings are made every 15 min. ***Remember - exercise periods at 0 and 30 min with a resting measurement between - then the treatment must be taken.***

### *Resting Heart Rate and Blood Pressure*

Resting heart rate (RHR, beats per minute) and Systolic (SBP) and diastolic (DBP) arterial blood pressure will be measured by an automatic blood pressure monitor.

1) Sit quietly without talking or moving for 5-10 minutes. (2) Place arm palm up on the bench, (3) place the cuff over the arm and position it 1cm above the elbow ensuring that the rubber tubing is on the inside of the arm, (4) secure the cuff by wrapping tightly (5) turn on the monitor and wait for the open heart symbol, (6) push the start button and wait while the cuff inflates and deflates, (7) record the resting heart rate (RHR) and Systolic (SBP) and diastolic (DBP) arterial blood pressure. The display alternates between the blood pressure measurements and the pulse rate

*Peak Expiratory Flow Rate*

**Lung function will be recorded with a peak flow meter. Correct use of the air flow meter will be demonstrated at the commencement of the class. Measure the peak expiratory flow rate (PEFR) reading (L/min).**

**Measurements during and post-exercise:**

***Exercise Heart Rate***

Exercise heart rate (EHR, beats per minute) will be measured by using the chest-strap heart rate monitors. To use these monitors apply a small drop of water to each ribbed section of the monitor. Place the monitor on the chest and adjust the strap so that the monitor makes a firm contact with the skin.

*Fatigue*

The following scale should be used to record the level of fatigue felt immediately after exercise.

<b>Fatigue</b>	<b><i>not at all</i></b>					<b><i>never felt more tired</i></b>
Scale:	1	2	3	4	5	

Exercise protocol

Each subject should exercise after taking resting measurements. Exercise times are 0, 30, 60, 90 and 120 mins (30 minute intervals). Each subject should ride the bike for 2 min at the power level (Watts) (shown on the bicycle ergometer) suited to their physical ability.

Females should maintain a power level of 120W

Males should maintain a power level of 150-170W

If at the above power levels your heart rate falls outside 45-80% of your maximum heart rate (*i.e.*220-age in years). Consult with a staff member on how you should modify the power level. However, DO NOT change the power level after you have taken the treatment.

**Maintain a constant power level during successive rides.**

**Only exercise at the allocated times**

**Between exercise-periods rest quietly**

**Recording of Observations**

1. Record each of the parameters at the times shown in the table on the results sheet.
2. Generate a graph for RHR, SBP, DBP, EHR, PEFR and fatigue from your group data
3. Add your group data to the class spreadsheets for each treatment group
4. Before leaving the class, break the blind and record which drug each subject was given.

Treatments

Treatment 1.....

Treatment 2.....

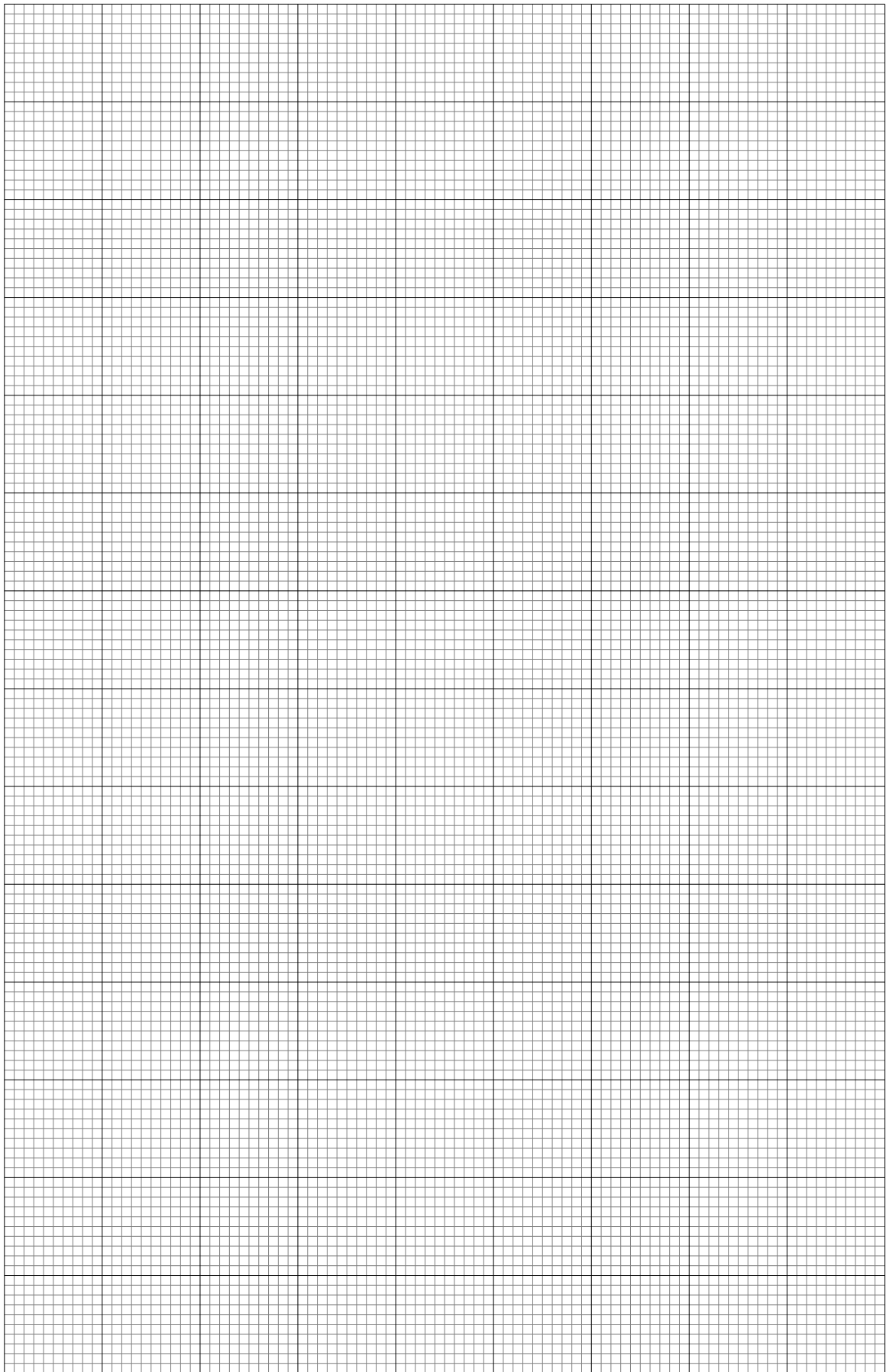
Treatment 3.....

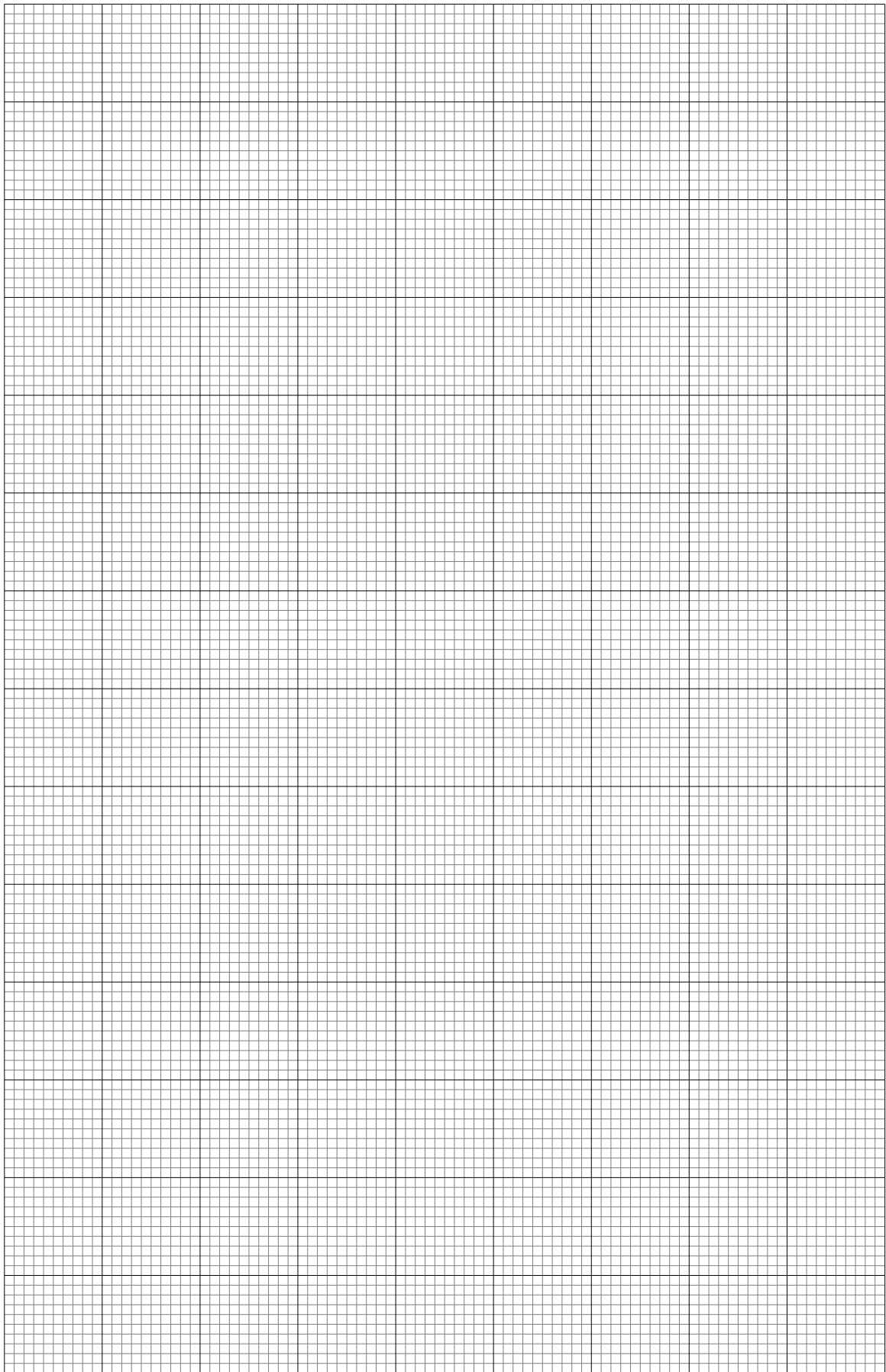
**Debriefing**

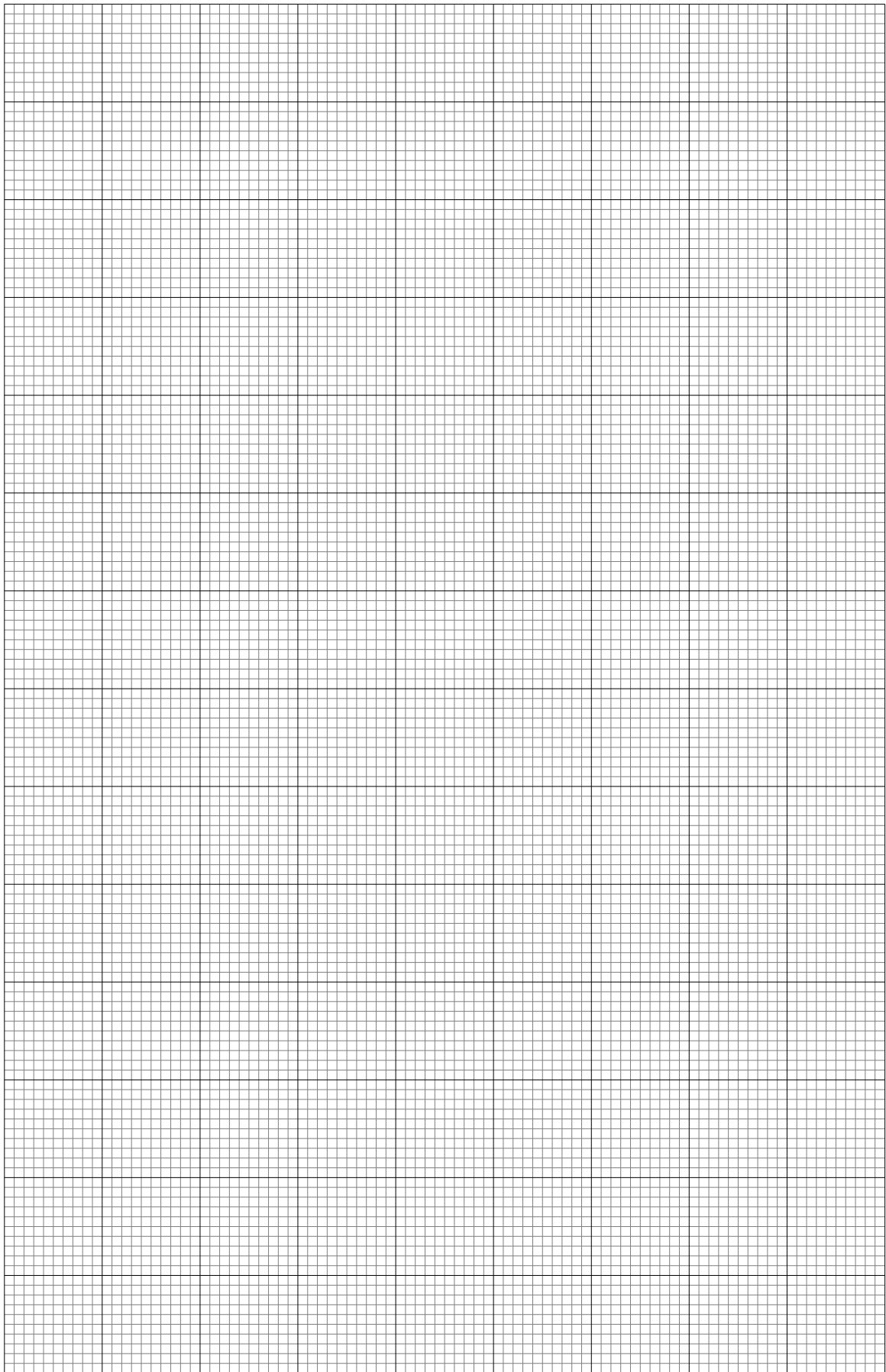
After the data has been collected and the drug treatments identified there will be a discussion of the effects of the drugs on the parameters measured.

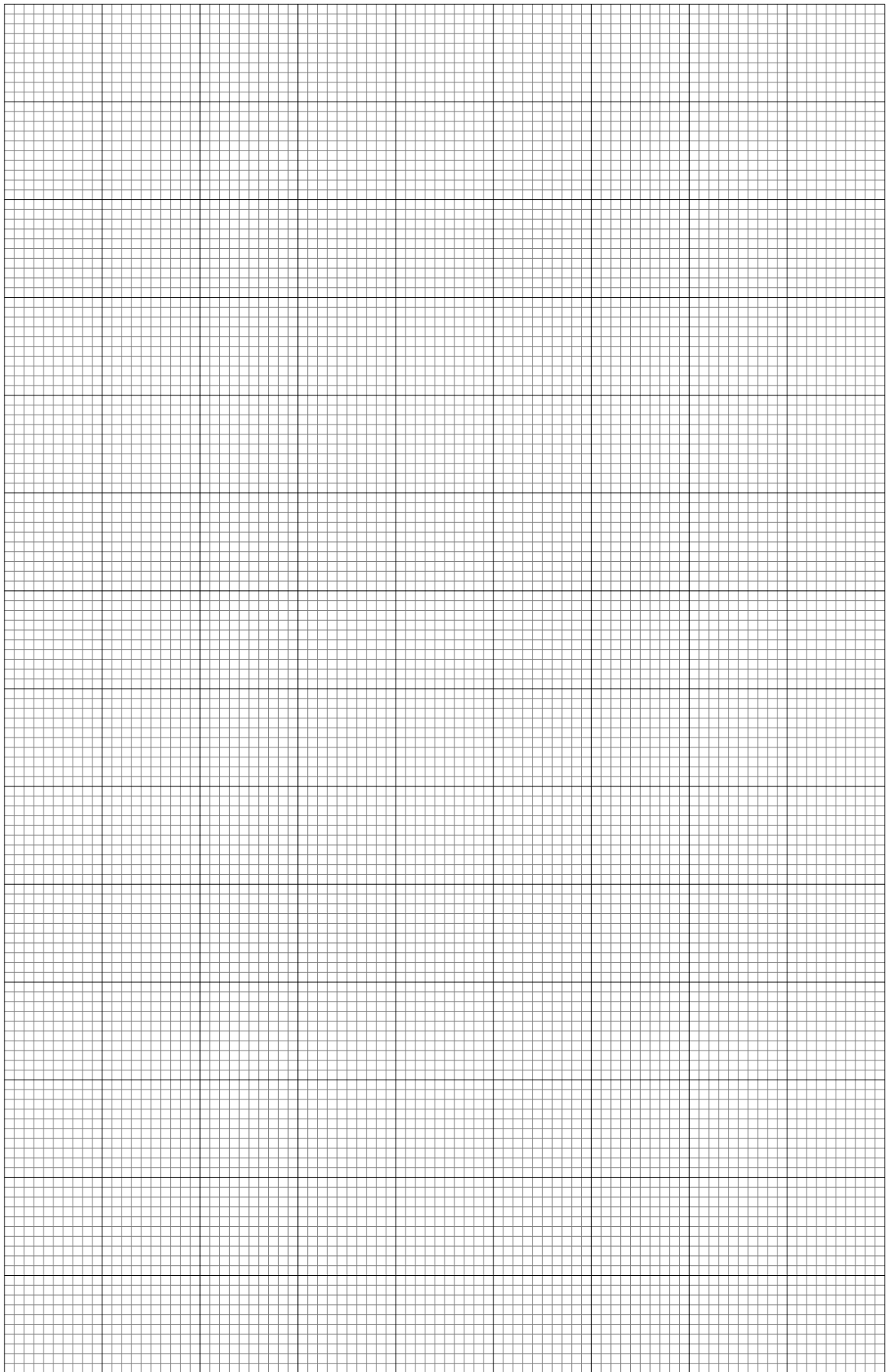


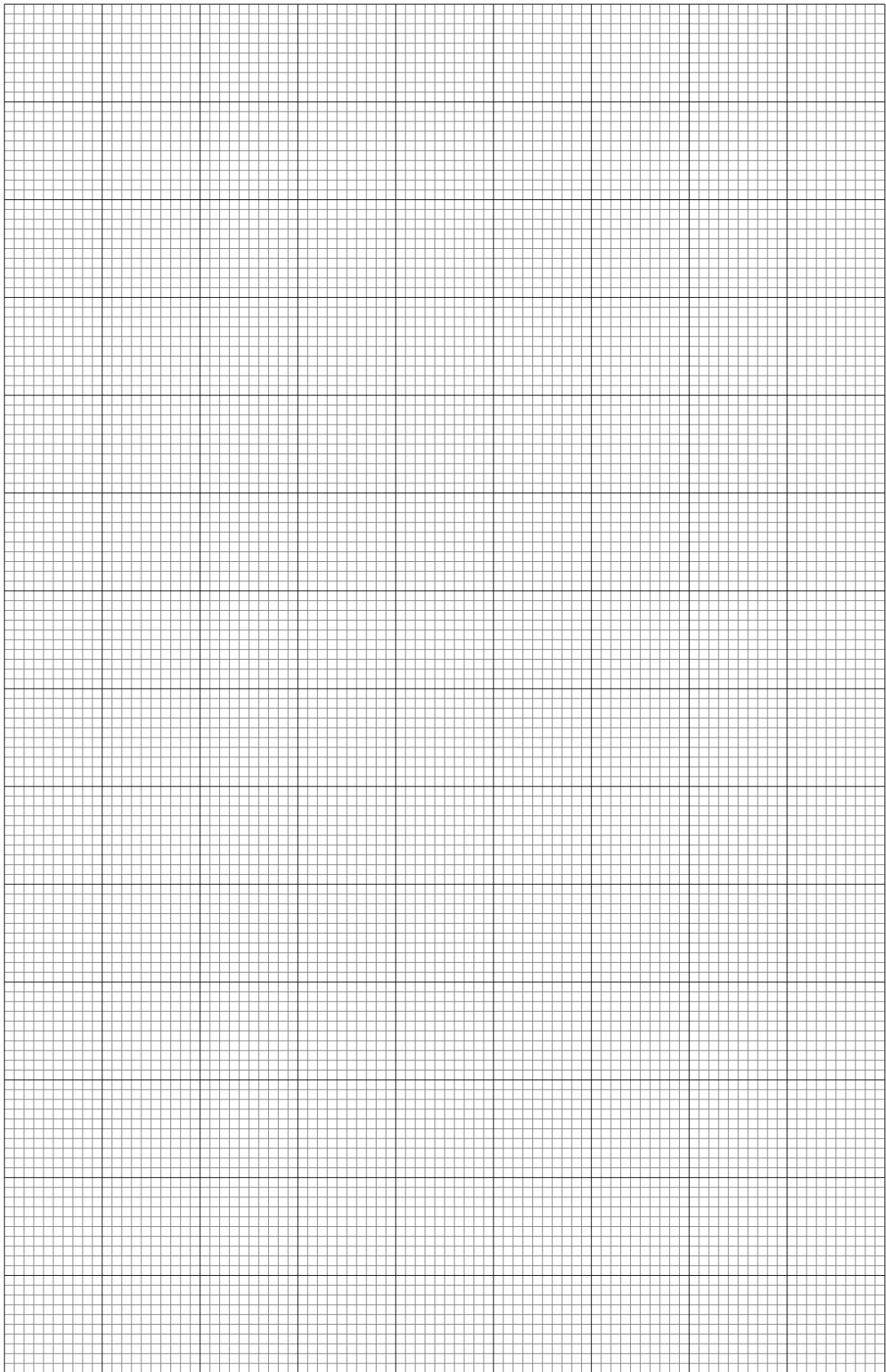
**Other Observations:**

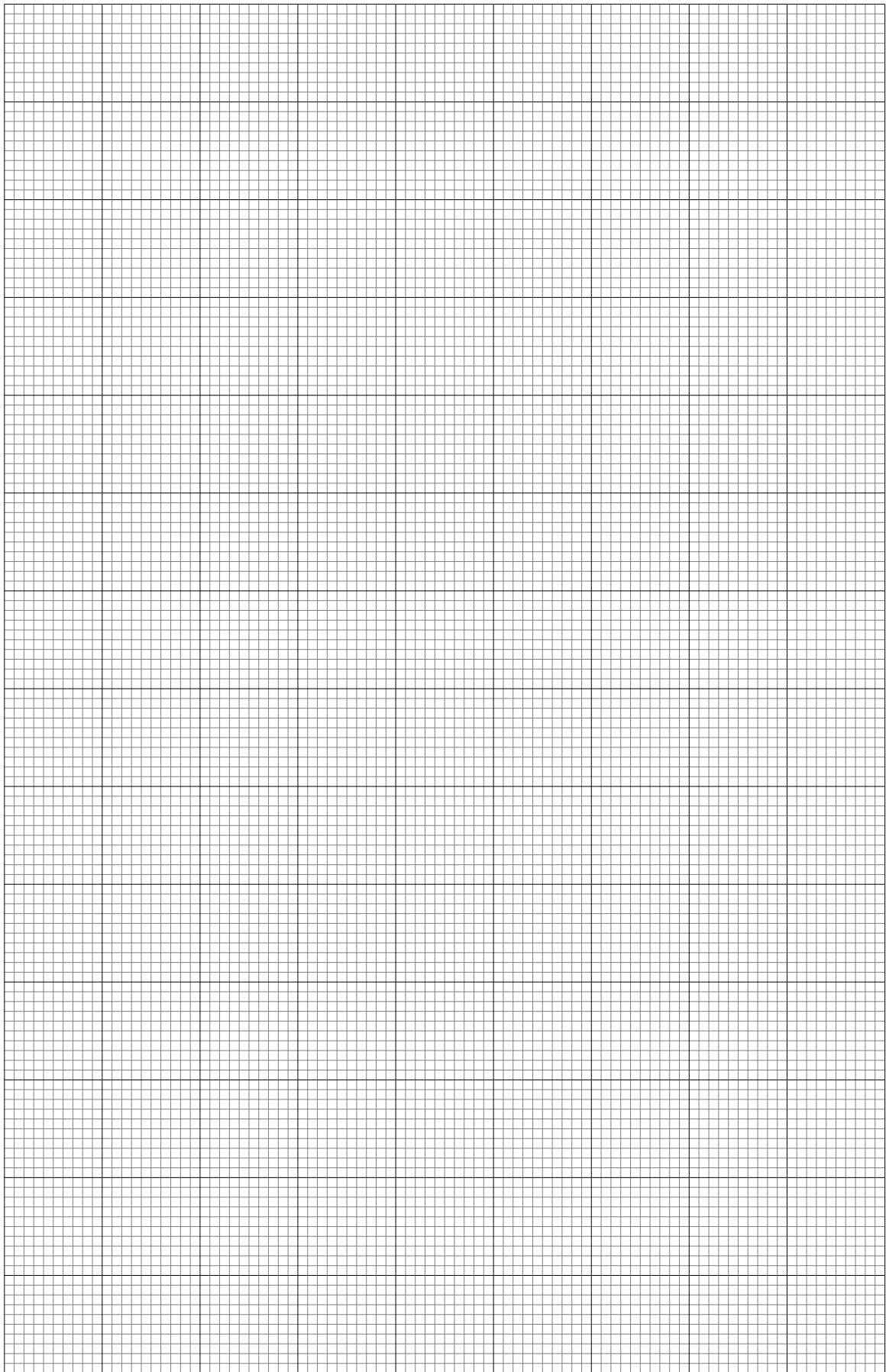












## DATA ANALYSIS

Open the files “Placebo”, “Atenolol” and “Pindolol”. These files can be found in the Practicals folder on the PPH3251 My eLearning Vista Page.

### Graph the data collected for each parameter

1. Open GraphPad Prism via the following path: Class programs \ Physiology and Pharmacology \ Utilities and Office applications \ Graph Pad Prism
2. Under New Tables and Graph choose “XY”.
3. Choose Graph “points and connecting lines”, for the Y values enter 10 replicates in side-by-side columns and plot a single y value”
4. Click “create”
5. Enter in the X-values column the times at which data was recorded.
6. Enter data of the measured responses for each treatment into the data table.
7. Label the Y- columns with the treatment names
8. View the graph by clicking on “Data 1” under the graph heading
9. You can change the appearance and scale of the axes by double clicking on them.
10. Label the axes.
11. Export or copy and paste the final graph into a word document
12. Click the “new” icon select “table and graph”
13. Repeat steps 1-10 for each parameter tested.

### Statistical Analysis

1. Open Data table
2. Click “analysis” button
3. Choose Grouped analysis/Two-way ANOVA
4. Check the Bonferroni post-test box
5. Insert variable names (ie Drug and Time)
6. Click OK
7. View tabular and narrative results

## RESULTS

1. Graphically represent the data obtained.
2. Indicate statistical significance where appropriate

## QUESTIONS TO CONSIDER

1. What effect would you expect  $\beta$ -adrenoceptor blockade to have on
  - (a) resting & exercise heart rates?
  - (b) resting blood pressure (systolic & diastolic)?
  - (c) lung function?Did you observe these effects? What is the physiological and pharmacological basis of these responses? If not can you give an explanation for you results?
2. Did you observe any differences in the profile of activity between atenolol and pindolol? If so how do these differences relate to the properties of atenolol and pindolol?

## **PRACTICAL REPORT: THE EFFECTS OF $\beta$ -ADRENOCEPTOR ANTAGONISTS ON EXERCISE INDUCED CARDIOVASCULAR CHANGES**

- Your written report should take the form of a scientific paper comprising of title, aims/introduction, results and discussion, following the format of a scientific paper submitted to the British Journal of Pharmacology. You are to follow the “Instructions to Authors” provided below.
- Reports must be legible and as concise as possible, and are limited to a maximum of 1500 words (excluding figures and figure legends).
- The report should be referenced using in-text referencing in the style of the British Journal of Pharmacology
- Written assessment tasks must be accompanied by a signed plagiarism form and placed in the locked box in room MG14 Wallace Wurth and submitted electronically via TURNITIN on the course VISTA page
- The report is to be submitted before 10am, 30<sup>th</sup> March (Grp 1.), 6<sup>h</sup> of April (Grp 2.) 2009. A penalty of 5% per day will apply for late submissions.

### **INSTRUCTIONS TO AUTHORS (adapted from British Journal of Pharmacology)**

Manuscripts must include in this order:

1. Title, Authors & Addresses
2. Introduction
3. Methods
4. Results
5. Discussion and conclusions
6. List of references
7. Figures and Legends

#### **Title, Authors and Addresses**

The title should be one sentence that contains less than 150 characters (including spaces). It must clearly indicate the subject matter of the paper, abbreviations should be avoided.

Following the title the name, student number and Departmental address (Dept of Pharmacology, Wallace Wurth, UNSW 2052) of the author should be given.

#### **Introduction**

The introduction should give a short and clear account of the background of the research topic. All previous research presented should be referenced. The final sentence should summarise the broad conclusions of the paper.

#### **Methods**

A brief description of the experiments should be given, including information such as the number of subjects and the drugs and dosage taken. The PHPH3251 course notes should be referenced.

## **Results**

A written description in paragraph format of the experimental results should be given. However, no conclusions or interpretation of results should be presented. This section is in addition to the figure legends.

## **Discussion and Conclusions**

The purpose of the discussion is to present a brief interpretation of the results against the background of existing knowledge. Repetition of the results (ie no numbers in the discussion) should be avoided. The main conclusions should be conveyed in a final paragraph.

## **References**

In the text, references to other work should take the form: (Bolton and Kitamura, 1983) or 'Bolton and Kitamura (1983) showed that... For further details of reference formatting, see the Formatting and Technical Instructions section.

## **Figures and Legends**

Figure legends should be typed on a separate page. Legends should explain the figures in sufficient detail that, whenever possible, they can be understood without reference to the text.

## **Formatting.**

Text should be times roman, 12 font, with 1.5 line-spacing throughout the manuscript. Margins at top and bottom and both side should be 3 cm.

## References

The reference list at the end of the manuscript must be arranged alphabetically according to the surname of the first author. When the surnames of first authors are identical, the alphabetical order of the surnames of subsequent authors takes precedence over the year of publication. The authors' names are followed by the year of publication in brackets. If more than one paper by the same authors in one year is cited, a, b, c, etc. are placed after the year of publication, both in the text and in the list of references. All authors should be quoted for papers with up to six authors; for papers with more than six authors, the first six should be quoted followed by et al. Entries in the reference list should conform to Harvard style. For example:

### *Journal Reference*

Connor M, Kitchen I (2006). Has the sun set on k3-opioid receptors? *Br J Pharmacol* **147**: 349–350.

### *Book Reference*

Finch AM, Sarramegna V, Graham RM. (2005). Ligand binding, activation and agonist trafficking. In: Perez DM (ed). *The Adrenergic Receptors, in the 21st Century*. Humana Press: New Jersey, pp 65–72.

## Units and Symbols

SI units and symbols should be used for physicochemical quantities.

# **Practical Class**

## **The Effects of Different Classes of Diuretic Drugs on Renal Output**

**PHPH3251**

**Session 1, 2009**

This practical is adapted with permission from: 1) the UNSW, Action of Diuretics in Human subjects, practical (1999), and 2) the University of Queensland, 'Diuretic Drugs' practical. February, 2008

# **SAFETY INSTRUCTIONS**

**Students acting as subjects in this practical are required to sign a consent form**

## **PRECAUTIONS AGAINST INFECTIONS**

**This practical class involves contact with human urine. Therefore, the following precautions must be taken.**

- i) All students should wear a laboratory coat.**
- ii) No eating, drinking or use of mobile phone is allowed in this practical class.**
- iii) Avoid direct contact with urine. When handling urine other than your own you must wear disposable gloves.**
- iv) If you have a past history of hepatitis or if you have any significant current infection, please do not volunteer to be an experimental subject.**
- v) When the experiment is complete dispose of all urine down the sink, and place all disposable test tubes and drinking cups into the bio-hazard containers provided.**
- vi) Avoid splashing or spilling of urine samples.**
- vii) Make sure that you wash your hands thoroughly at the end of the class.**

# PRE LAB INSTRUCTIONS

## for

### The Effects of Different Classes Of Diuretic Drugs On Renal Output

#### VOLUNTEERS:

Volunteers will be required for this practical session.

You should NOT volunteer if you:

- have a cardiovascular
- have a renal condition or kidney disorder/ disease
- have hepatic disease or disorder
- have diabetes mellitus
- are pregnant or breast feeding
- have a sulfonamide sensitivity
- have an autoimmune disorder (e.g. Systemic Lupus Erythrematosus)

Please notify the attending Doctor or Laboratory Coordinator if you have taken any medication within the past 24 hours.

Volunteers should restrict alcohol and caffeine (i.e. coffee & Tea) intake in the 24 hours before the experiment, and restrict strenuous exercise for 12 hours after taking drugs.

Once you have taken the drug, do not leave at the end of the practical class without notifying a demonstrator.

All participating students must complete a consent form before beginning the experiment.

## LEARNING OBJECTIVE

To develop an understanding of the pharmacological responses to clinically relevant diuretic compounds in humans through quantification of relevant clinical and biochemical responses.

## INTRODUCTION

Diuretics mobilise tissue oedema by increasing sodium excretion and subsequent urine volume. Thus, these compounds are useful in the treatment of congestive states, such as heart failure. Diuretics are effective antihypertensive drugs, lowering diastolic blood pressure by 10-15 mmHg. Ion transport in the nephron is dependent on the section of the nephron examined. Therefore, diuretics with different sites of action will alter the ionic composition of the urine to different degrees.

This practical will examine 3 compounds with different modes of action as diuretics - caffeine, acetazolamide and hydrochlorothiazide.

Coffee contains caffeine, a methylxanthine, which produces diuresis probably as a result of an increased renal blood flow and glomerular filtration rate.

Acetazolamide inhibits renal carbonic anhydrase: thus, less  $H^+$  is secreted and less bicarbonate (and  $Na^+$ ) is reabsorbed. Acidosis develops which stops the diuresis; tolerance develops.

The thiazide diuretics such as hydrochlorothiazide inhibit the reabsorption of  $Na^+$  and  $Cl^-$  at the beginning of the distal convoluted tubule.

In this experiment, the effect of a single dose of each compound will be examined on a number of parameters involved in renal and cardiovascular function. Volunteers will measure their urine volume; the other members of each group will determine ion concentrations and osmolality of the urine samples, heart rate and blood pressure of the volunteers.

## Experimental protocol for volunteers

### ***PLEASE NOTE CAREFULLY!***

1. Consume a normal breakfast with the exception of tea, coffee or chocolate. Drink about 500 ml of water (2 cups) at around 9am.
2. Strenuous exercise should be avoided on the day of the experiment.
3. Do not smoke or drink, other than required for the experiments, during the experimental period. (please do not eat lunch until after the experimental period)
4. At 11.00am, arrive at the laboratory for brief prac specific medical assessment (Bp & Heart rate etc)..
5. At about 11:30am (note time), empty bladder again but this time collect the urine. Measure urine volume and retain a sample (about 20ml) as control.
6. After emptying bladder (i.e. at 11:30am) immediately take assigned diuretic compound with 250ml of water. The appropriate doses are:
  - a. Control (250 ml Water only)
  - b. caffeine (equivalent to 4 teaspoons of coffee)
  - c. acetazolamide 250mg
  - d. hydrochlorothiazide 50mg
7. Every 20 minutes for the next 2 hrs-
  1. Empty bladder and collect urine sample (about 20ml), noting time.
  2. Another member of your group will measure your heart rate and blood pressure just before you produce each urine sample.

### **Experimental protocol: data collection and analysis**

1. A member of the group must measure the pulse rate and blood pressure of each volunteer shortly before production of each urine sample (i.e. every 20 min).
  2. Convert urine volume to urine flow rate ( $V$ , ml/min).
  3. Measure pH immediately ( $\text{CO}_2$  is lost quickly) using indicator sticks provided.
  4. Measure osmolality of the urine sample ( $U_{\text{osm}}$ , mosmol/Kg).
  5. Measure  $\text{Na}^+$  and  $\text{K}^+$  concentrations using the flame photometer and convert into mmoles excreted/min.
- All results from your group should be added to the combined class result table throughout the practical session. You will use the complete set of class results from all groups for answering the questions and discussion of the practical.

### **Treatment of data**

1. Complete data tables for each of the volunteers.
2. Plot urine flow rate, pH, osmolality, osmolar excretion and the excretion of  $\text{Na}^+$  and  $\text{K}^+$  against time.

### **Questions**

1. Distinguish each diuretic compound by its effects on fluid and electrolyte excretion.
2. Discuss any changes in cardiovascular parameters during the experiments.
3. Why are thiazides the most used diuretics?
4. Why would frusemide be substituted for hydrochlorothiazide in the treatment of heart failure? Are there possible disadvantages to this substitution?
5. What are the consequences of excessive  $\text{K}^+$  -depletion by diuretics? What are the options to overcome hypokalaemia?





**PARTICIPANT INFORMATION STATEMENT AND  
CONSENT FORM**

**APPROVAL No:** HREC ...08050.....

**Practical class – The Effects Of Different Classes Of Diuretic Drugs On Renal Output**

As an enrolled student you are invited to participate as a volunteer in a class that will help to develop your understanding of the pharmacology of diuretic compounds. Participation as a volunteer will entail your ingestion of either acetazolamide (250 mg) OR hydrochlorothiazide (50 mg) OR caffeine (2 cups with 2 teaspoons of coffee per cup). You may not know the identity of the drug that you will consume as this is a single blind study but you will be told at the completion of the class. As a volunteer in this practical class, you will ingest this drug in the first 30 minutes of the class and you are expected to volunteer for the whole class which will last for 3 hours. The diuretics, acetazolamide and hydrochlorothiazide used in this practical session are safe and widely used drugs in the patients with disorders such as hypertension, peripheral oedema and glaucoma . As with any medication there is the potential for adverse reaction. However, provided exclusion criteria are adhered to and with the exception of anaphylaxis which is rare, adverse events are extremely unlikely after a single dose as used in this practical session.

Any student with a history of cardiovascular or kidney or autoimmune (e.g. SLE) disorders, asthma, sulphonamide allergies, diabetes, metabolic disease or who is pregnant or breastfeeding **may be** excluded from participating as a volunteer in this class.

Although rare the following reactions have been reported in patients taking acetazolamide: sulfonamide reactions including rash, Stevens-Johnson syndrome, hepatic, haematological, electrolyte disturbances, paraesthesia, decreased appetite, polyuria, polydipsia, headache, flushing, malaise, drowsiness, flaccid paralysis, fever; GI upset, crystalluria, hypoglycaemia, hyperglycaemia, tinnitus.

Hydrochlorothiazide is usually well tolerated however minor adverse reactions have been reported after regular use, with significant adverse effects generally associated with the diuresis. Possible adverse reactions include; gastric irritation, nausea, vomiting, cramping, diarrhea, constipation, sialadenitis, dizziness, vertigo, headache, hypotension, rash, fever, anaphylactic reactions, hyperglycaemia, glycosuria, hyperuricaemia, electrolyte imbalance, including hyponatraemia and hypokalaemia, muscle spasm, weakness, restlessness, transient blurred vision.

The doses (acetazolamide 250 mg and hydrochlorothiazide, 50 mg) used in this practical class are within the recommended therapeutic dosage for these drugs.

A registered medical doctor (from the staff in The School of Medical Sciences) will be in attendance to advise students with regards to any medical conditions or concurrent medications that may affect their participation as a volunteer.

Unidentified group data from this class will be shared with the rest of the class. Attendance sheets, consent forms and incident reports will be kept for a period of 7 years. Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without prejudice. If you have any questions, please feel free to ask any demonstrator on this class. If you have any additional questions later, Dr Ross Grant, ([r.grant@unsw.edu.au](mailto:r.grant@unsw.edu.au)), will be happy to answer them.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, Sydney 2052 Australia (phone 9385 4234, fax 9385 6648, email [ethics.sec@unsw.edu.au](mailto:ethics.sec@unsw.edu.au) ). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

APPROVAL No: HREC...08050.....

**PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)**

**Practical class – The Effects Of Different Classes Of Diuretic Drugs On Renal Output**

**THE UNIVERSITY OF  
NEW SOUTH WALES**



SCHOOL OF MEDICAL SCIENCES

I understand that I am making a decision as to whether or not to participate as a volunteer for the above practical class. My signature indicates that, having read the Participant Information Statement, and the practical notes which explain the full procedure, I have decided to take part in the study.

I understand that if I have any questions relating to my participation as an experimental volunteer in this practical class I may ask the demonstrator in charge of the class who will be happy to answer them. I understand that my participation as a volunteer is voluntary and that I can withdraw from being a volunteer at any time without prejudice to my relationship with the University of New South Wales.

<b>Volunteers' name</b>	<b>Signature</b>	<b>Volunteers' name</b>	<b>Signature</b>

.....  
Witnessed by

.....  
Date

.....Please PRINT Name of witness

# Practical Class

## Pain Management – the action of NSAIDS

PHPH3251

Session 1, 2009

### LEARNING OBJECTIVE

To develop students awareness of the role of perception in the selection of pharmacotherapy for pain management and to highlight the differences in pharmacological action of selected analgesic medications.

### INTRODUCTION

Non-steroidal anti-inflammatory drugs (NSAIDs) are among the most commonly used of all drugs and are a mainstay in acute and chronic pain management. Most of these drugs have three major types of effect: analgesic, anti-inflammatory, and anti-pyretic. Their combined anti-inflammatory and analgesic actions render them particularly suitable for use against inflammatory pain such as that associated with arthritis. The primary mechanism of action of NSAIDs is through the inhibition of cyclooxygenase, an enzyme involved in the synthesis of prostaglandins. There are at least two types of cyclo-oxygenase enzymes COX -1 and COX – 2. COX-1 is a constitutive enzyme involved in tissue homeostasis, whose inhibition results in most of the gastric side-effects of NSAIDs. COX-2 is induced by inflammatory cytokines and is thus enhanced in inflammatory conditions.

To manage pain successfully, particularly chronic pain, the first step when determining an appropriate treatment or drug dosage is to *assess the patient's pain level*.

Table 1: Class outline

Time	0-30 min	30-90 min	90-110 min
Activity	Devise Pain Scale	Case studies; internet search; prepare reports	Each group has 3 min presentation on either Case or Pain Scale

### Methods for assessing pain:

Methods you should consider include:

Observation, Visual analogue scale, Numerical rating scale, Verbal descriptions, and Questionnaire

*In this practical class you will assess the various forms of pain measurement and apply these techniques in three different scenarios.*

## PRACTICAL CLASS PROCEDURE

*The practical class will be divided into 9 groups (containing ~5 people each).*

1. **Devise a method for measuring a patient / subject's pain.** You may conduct a search for pain measurement techniques using the class computers provided. When designing a pain scale consider what problems might be encountered in measuring pain. How reliable are these measures?
2. **When you are satisfied you are able to assess a patient's pain approach two of the three subject cases** (according to table 2). Take a careful history (Use patient history forms provided) and assess their pain using the pain scale you have devised. (You should aim to spend no more than 5 - 6 minutes questioning each subject case).
3. **Identify the cause & plan an appropriate pharmaceutical treatment strategy to manage the subject's pain.**  
Each subject will have one set of questions associated with their case history, and each group will be assigned two topics (according to table 2). At the end of the class one group covering each topic will be selected to give a three minute presentation either on their topic or their pain measurement technique.

Factors to consider when taking a pain history

- Circumstances associated with pain onset
- Primary site of pain
- Radiation of pain to other body areas
- Character of pain e.g. sharp, stabbing, burning, aching
- Intensity of pain (use pain measurement techniques you have researched)
- Timing of pain (when does it begin and how long does it last)
- Effect of pain on patients quality of life e.g. during activities or sleep
- Medications taken for pain relief.

**Table 2: Case Study and Research questions allocations**

**Note: Selected groups will also be asked to present their pain scales**

<b>Group</b>	<b>Case Study</b>		
I	Case A	Case B	<b>Your group should be prepared to present either of the two cases researched and provide answers to the case questions</b>
II	Case A	Case C	
III	Case B	Case C	
IV	Case A	Case B	
V	Case A	Case C	
VI	Case B	Case C	
VII	Case A	Case B	
VIII	Case A	Case C	
IX	Case B	Case C	

### **Case Study / Scenario A**

#### ***Patient management questions – (students to complete and prepare presentation)***

Question 1:

Are opioids appropriate in the management of pain resulting from fractures?

Question 2:

What are the contraindications and potential side effects of opioid use in pain relief?

Question 3:

What alternative analgesics or medications are available to treat fracture pain?

### **Case Study / Scenario B**

#### ***Patient management questions – (students to complete and prepare presentation)***

Question 1:

What are the contraindications and side effects of celebrex?

Question 2:

Would you reinstate the celebrex? Why or why not?

Question 3:

What alternative medications are available for a patient with this condition?

### **Case Study / Scenario C**

#### ***Patient management questions – (students to complete and prepare presentation)***

Question 1:

What is the cause of her increased bruising? (describe the mechanism).

Question 2:

Is the gastric discomfort associated with her condition or treatment, how would you determine this?

Question 3:

What alternative treatment would you recommend for this condition that would not have the undesirable effects of aspirin?



### PATIENT HISTORY FORM (for class use only)

Note: (If you consider the gathering of any of the information listed below **unnecessary** to this case please write N/A across that section).

Today's Date: \_\_\_\_\_ Case: \_\_\_\_\_ Group: \_\_\_\_\_

Pts Age: \_\_\_\_\_ Students conducting examination 1. \_\_\_\_\_ 2. \_\_\_\_\_

3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_

### HISTORY OF PRESENT ILLNESS

**Pain History:**

What is the main reason for the patients visit today? (Describe the problem in detail)

---

---

---

Location of the problem:

How long does the problem last?

---

---

Pain assessment (use group prepared scale),

Is anything else occurring at the same time?  
Yes No If yes, please explain.

---

When did the patient first notice the problem?

Is the problem constant or variable?  
Dull then sharp Very sharp then stops

Other \_\_\_\_\_

### PAST MEDICAL AND SOCIAL HISTORY

Record all serious illnesses in this patients immediate family. Examples include Diabetes, Tuberculosis, Heart Disease, Breast Cancer, etc.

(NOTE: If you consider the gathering of any or all of the information listed below **unnecessary** to this case please write N/A across that section).

---

---

---

List past Illnesses / Surgeries

Date

_____	_____
_____	_____
_____	_____

Is the patient on any medications? **Yes** **No** (If yes, list all)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Do you smoke? Yes No

If yes, how much? \_\_\_\_\_

Are you allergic to any medications or food? Yes No

If yes, please explain \_\_\_\_\_

Do you drink? Yes No

If yes, how much? \_\_\_\_\_

Have you ever had a blood transfusion? Yes No

If yes, please explain \_\_\_\_\_

### Review of Systems

Circle **Yes** or **No** to the questions below;

**Does the patient now have or have they had any problems related to the following systems?**

(**NOTE:** If you consider the gathering of any or all of the information listed below **unnecessary** to this case please write N/A across that section).

---

#### Gastrointestinal

Abdominal Pain Y N

Constipation Y N

Diarrhea Y N

Other \_\_\_\_\_

#### Cardiovascular

Chest Pain Y N

Varicose veins Y N

High Blood Pressure Y N

Other \_\_\_\_\_

**Musculoskeletal**

Joint pain                    Y     N

Neck pain                    Y     N

Back pain                    Y     N

Other \_\_\_\_\_

**Neurological**

Tremors                    Y     N

Dizzy spells                Y     N

Numbness / Tingling    Y     N

Other \_\_\_\_\_

Adapted from: LONG ISLAND JEWISH MEDICAL CENTER – DEPARTMENT OF UROLOGY



### PATIENT HISTORY FORM (for class use only)

Note: (If you consider the gathering of any of the information listed below **unnecessary** to this case please write N/A across that section).

Today's Date: \_\_\_\_\_ Case: \_\_\_\_\_ Group: \_\_\_\_\_

Pts Age: \_\_\_\_\_ Students conducting examination 1. \_\_\_\_\_ 2. \_\_\_\_\_

3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_

### HISTORY OF PRESENT ILLNESS

**Pain History:**

What is the main reason for the patients visit today? (Describe the problem in detail)

---

---

---

Location of the problem:

How long does the problem last?

---

---

Pain assessment (use group prepared scale),

Is anything else occurring at the same time?  
Yes No If yes, please explain.

---

When did the patient first notice the problem?

Is the problem constant or variable?  
Dull then sharp Very sharp then stops

Other \_\_\_\_\_

### PAST MEDICAL AND SOCIAL HISTORY

Record all serious illnesses in this patients immediate family. Examples include Diabetes, Tuberculosis, Heart Disease, Breast Cancer, etc.

(NOTE: If you consider the gathering of any or all of the information listed below **unnecessary** to this case please write N/A across that section).

---

---

---

List past Illnesses / Surgeries

Date

---

---

---

---

---

---

Is the patient on any medications? **Yes** **No** (If yes, list all)

---

---

---

Do you smoke? Yes No

If yes, how much? \_\_\_\_\_

Are you allergic to any medications or food? Yes No

If yes, please explain \_\_\_\_\_

Do you drink? Yes No

If yes, how much? \_\_\_\_\_

Have you ever had a blood transfusion? Yes No

If yes, please explain \_\_\_\_\_

### Review of Systems

Circle **Yes** or **No** to the questions below;

**Does the patient now have or have they had any problems related to the following systems?**

(**NOTE:** If you consider the gathering of any or all of the information listed below **unnecessary** to this case please write N/A across that section).

---

#### Gastrointestinal

Abdominal Pain Y N

Constipation Y N

Diarrhea Y N

Other \_\_\_\_\_

#### Cardiovascular

Chest Pain Y N

Varicose veins Y N

High Blood Pressure Y N

Other \_\_\_\_\_

**Musculoskeletal**

Joint pain                    Y     N

Neck pain                    Y     N

Back pain                    Y     N

Other \_\_\_\_\_

**Neurological**

Tremors                    Y     N

Dizzy spells                Y     N

Numbness / Tingling    Y     N

Other \_\_\_\_\_

Adapted from: LONG ISLAND JEWISH MEDICAL CENTER – DEPARTMENT OF UROLOGY

# PHARMACOKINETICS

## PHPH3251

### Session 1, 2009

#### LEARNING OBJECTIVE

To gain an understanding of pharmacokinetic parameters and their significance in pharmacology.

#### PRACTICAL CLASS PROCEDURE

An exercise containing a set of plasma concentrations for a drug versus time will be allocated to each student.

Plot the data on semi-logarithmic graph paper.

Calculate the following pharmacokinetic parameters for the drug you have been assigned:

1. half-life
2. clearance
3. volume of distribution

You must check your answers with a demonstrator before leaving the class.

#### PHARMACOKINETIC PARAMETERS

##### Half-life ( $t_{1/2}$ )

= the time taken for the plasma concentration to fall by half.

This parameter can be obtained directly from the semi-logarithmic plot of the plasma concentration-time data, read off the log-linear (excretion) phase of the graph.

##### Elimination rate constant (k)

The elimination rate constant  $k$  = the slope of the log-linear phase of the semi-logarithmic plot of the plasma concentration-time data. If the half-life ( $t_{1/2}$ ) is known then:  $k = 0.693 / t_{1/2}$

##### Area under the plasma concentration-time curve (AUC)

According to the trapezoidal rule, the area under a drug concentration-time curve can be estimated by assuming that the area can be represented by a series of trapezoids (Figure 1). The total area will be the sum of the areas of the individual trapezoids.

$$\text{i.e. } \text{AUC} = \frac{1}{2}(C_0+C_1)(t_1-t_0) + \frac{1}{2}(C_1+C_2)(t_2-t_1) + \dots + \frac{1}{2}(C_{n-1}+C_n)(t_n-t_{n-1})$$

where  $C_n$  and  $t_n$  are drug concentrations and time, respectively.

This method allows for the determination of the AUC to the last concentration-time point. To determine the remaining area the last concentration point is divided by the elimination rate constant i.e.  $AUC_{(C_n \rightarrow \infty)} = C_n/k_e$

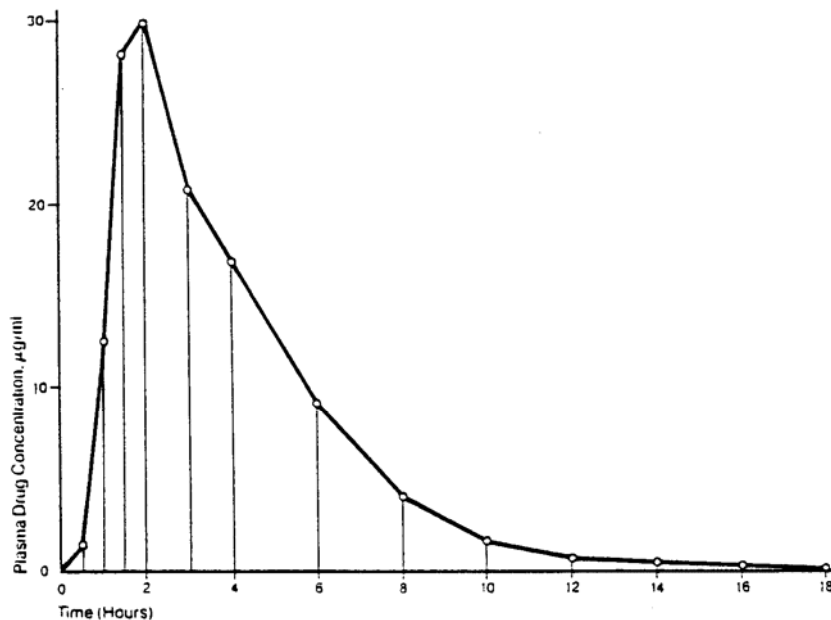


Figure 1. Estimation of area under the drug concentration-time curve using the trapezoidal rule.

Note

**For intravenous dosage** the concentration at zero time needs to be estimated. This is achieved by extrapolating the distributional phase of the semi-logarithmic plot of the plasma concentration-time data back to the y-axis and reading off the concentration.

**For oral dosage** the first concentration and time point is 0, 0.

Clearance (CL)

The clearance of the drug can be calculated using the following equation:

$$CL = F \times \text{dose}/AUC$$

where F = the fraction of the dose absorbed.

For intravenous dosage F = 1.

Units for clearance are ml/min.

Volume of distribution (Vd)

The volume of distribution of the drug can be calculated using the following equation:

$$Vd = t_{1/2} \times CL/0.693$$

Units for volume of distribution are litres.

Bioavailability (F)

In some exercises the fraction of the dose that is absorbed (F) must be calculated.

$$F = \frac{\text{Dose}_{\text{IV}}}{\text{AUC}_{\text{IV}}} \times \frac{\text{AUC}_{\text{oral}}}{\text{Dose}_{\text{oral}}}$$

or

$$F = \frac{\text{AUC}_{\text{oral}}}{\text{AUC}_{\text{IV}}} \quad \text{if oral and IV doses are the same}$$

### **COMPUTER PROGRAM FOR AUC AND HALF-LIFE**

A computer program is available to calculate the area under the curve using the trapezoidal rule.

To access this program go to **Class programs** → **Pharmacology** → **Pharmacokinetics** and enter your data,

- Leave the first data point as 0,0.
- You need to specify the route of administration.
- You must identify the number of points that lie on the terminal linear phase of your semi-log graph and enter this number in “number of points to regress”.

The computer will determine the line of best fit for your data and also calculate the slope of the line or k (the elimination rate constant).

The program will also calculate the terminal half-life from this data and the total area under the curve which can then be used to calculate clearance and hence volume of distribution (Vd).

### **YOUR WRITTEN REPORT**

A report (two pages plus graphs) on the pharmacokinetics and pharmacology of the particular drug is to be submitted.

**NOTE:** The write up for this **practical** will require you to answer the questions below. A formal report write-up (as previously required for the  $\beta$ -blocker prac) will not be required

#### ***Your report must contain the following:***

1. The clinical use and major side effects associated with the drug (very brief).
2. The mode(s) of elimination of the drug.
3. A clearly labelled, semi-logarithmic plot of the time course of plasma concentrations of the drug.
4. The calculated pharmacokinetic parameters for the drug.
5. The therapeutic range of plasma concentrations of the drug (where known).
6. The clinical significance of the pharmacokinetics parameters that you have calculated. In your discussion consider:
  - (a) What parameters (if any) may be changed in disease states or by dosage with other drugs.
  - (b) How do the pharmacokinetic parameters affect the dosage regimen of the particular drug.

# PAST EXAM PAPERS

## June 2007 CLINICAL & EXPERIMENTAL PHARMACOLOGY

**PART B** consists of 7 short answer questions, You are to answer any 5 questions  
Each question is worth 10 marks.

1. Describe; (i) the main factors affecting pain measurement and (ii) how the opioids modulate neurotransmission to inhibit pain.
2. Explain in detail why angiotensin converting enzyme (ACE) inhibitors are useful in the treatment of heart failure.
3. Explain, (i) What is a migraine, (ii) What can be done to prevent acute migraine attacks. (iii) When is prophylactic medication indicated.
4. Compare the causes, symptoms and options for treatment of gastroesophageal reflux disease and stomach ulcer.
5. Describe the main features of chronic airway limitation [CAL] and the drug classes used in the pharmacological management of this condition.
6. (i) Compare and contrast the pharmacological approach of L-dopa therapy for Parkinson's disease with anticholinergic therapies for Alzheimer's disease.  
(ii) What clinical benefit does each of these treatments have?
7. (i) How do orlistat and phentermine lead to weight loss?  
(ii) What are the adverse effects associated with their use?

**PART C** consists of 5 long answer questions, You are to answer any 3 questions  
Each question is worth 15 marks.

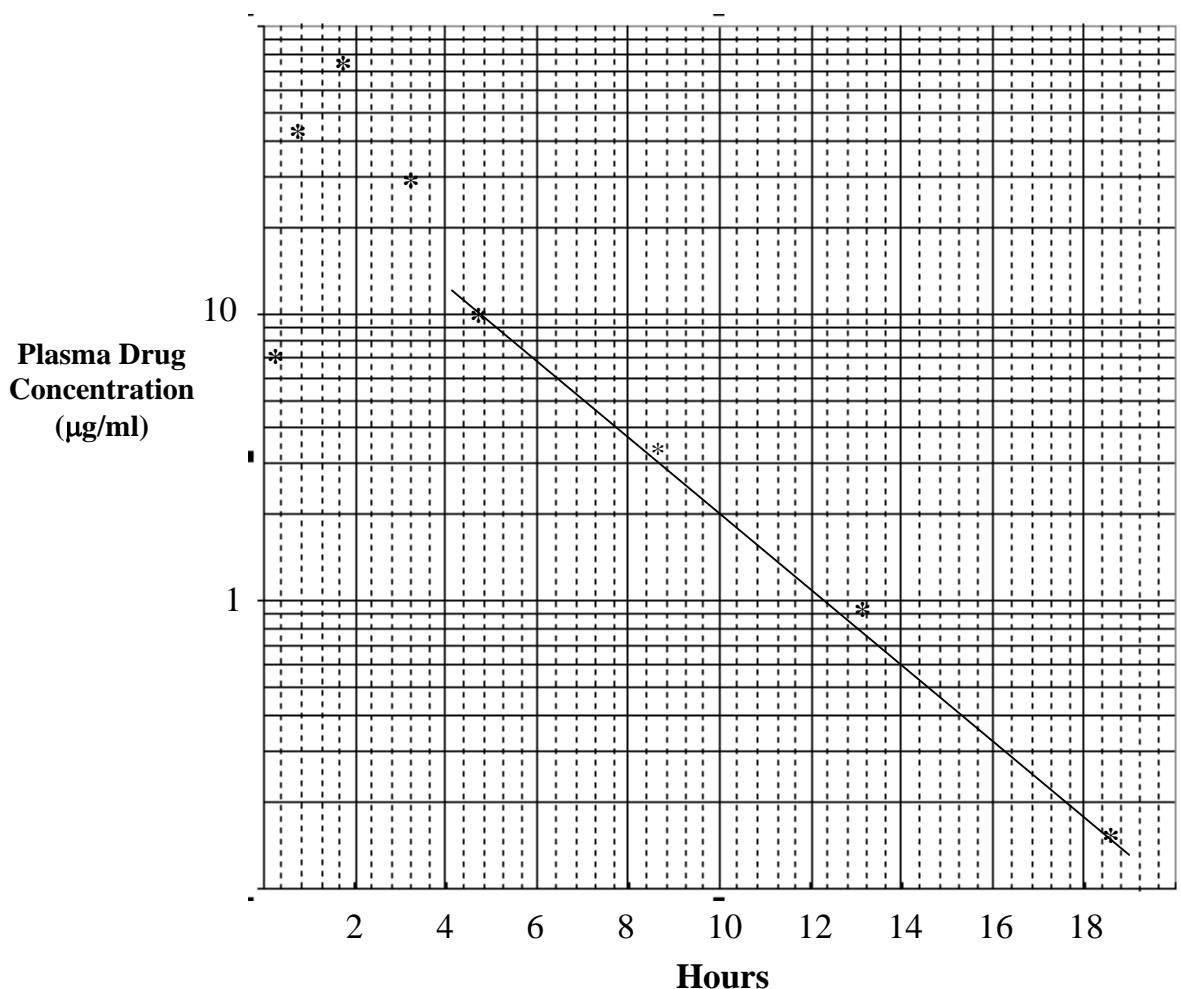
1. (i) Describe the mechanism of action of the antidepressant drugs Fluoxetine.  
(ii) How does this differ from the mechanism of action of the monoamine oxidase inhibitor moclobemide  
(iii) Contrast the side effect profile of each drug
2. Compare and contrast the pharmacological management of type 1 and type 2 diabetes.
3. The formation of thrombosis can lead to disease states such as myocardial infarct and deep vein thrombosis.  
(i) List the two processes that can be modulated to prevent thrombosis formation.  
For each process name a drug and describe the mechanism of action by which it prevents thrombosis formation.  
(ii) What class of drugs can be used post-myocardial infarct to remove the formed clot, give one example of a drug in this class and its mechanism of action?
4. Discuss why cancer is so difficult to cure, and outline, with named drug examples, the principal mechanisms by which anticancer drugs kill tumour cells.
5. Answer questions a) and b) with reference to the pharmacokinetic information and graph shown below:  
  
a) Calculate the;  
i) Rate of elimination ( $K_e$ ),  
ii) Half life ( $T_{1/2}$ )  
iii) Clearance (CL)  
iv) Volume of distribution ( $V_d$ )  
b) Discuss the pharmacokinetic behaviour and characteristics of this drug

### **Pharmacokinetic information**

Single oral dose = 800 mg

Total AUC = 300  $\mu\text{g/ml/hr}$

Bioavailability (F) = 0.7



### June 2006 CLINICAL & EXPERIMENTAL PHARMACOLOGY

1. Infection with what organism is often implicated in the aetiology of peptic ulcer disease? What drug(s) are commonly used to treat this disease and what is their underlying mechanism of action?
2. Give five reasons why dopamine receptors are thought to be involved in the pathogenesis of schizophrenia
3. Arterial thrombosis can lead to myocardial infarct:
  - a. Describe the two processes that can be modulated to prevent thrombosis formation. For each, give an example of a drug that regulates that process
  - b. What class of drugs can be used, post-myocardial infarct, to remove the formed clot. Give one example of a drug in this class.
4. Describe the differences in the mode of action of  $\alpha_2$  adrenoceptor agonists and glucocorticoids in the treatment of asthma; include examples in your answer
5. Explain the pharmacological basis of L-dopa treatment for Parkinson's disease. What pharmacological approach is used to enhance this treatment
6. Explain how the following drug groups are thought to produce their antihypertensive action:
  - a. calcium channel blocking agents
  - b. angiotensin converting enzyme (ACE) inhibitors
7. Selective COX-2 inhibitors are a recent addition to anti-inflammatory therapy:
  - (a) Describe the physiological rationale for the development of the COX-2

- inhibitors (b) Why has the use of rofecoxib been ceased? Outline the probable mechanism of its major adverse reaction?
8. List the different classes of drugs used to treat Type-2 diabetes and discuss their mechanism of action
  9. Contrast the mechanism of action (and adverse effects) of sibutramine and orlistat in the management of obesity.
  10. Discuss, with named drug examples, the mechanisms by which anticancer drugs kill tumour cells
  11. Discuss, with named drug examples, the mechanisms by which antimicrobial agents kill bacteria or inhibit their growth.
  12. List the five (5) main classes of antidepressant medication and briefly describe the mechanism of action of each

### **November 2005 CLINICAL & EXPERIMENTAL PHARMACOLOGY**

1. Describe the involvement of dopamine in drug dependence; include examples in your answer.
2. What pharmacological approaches are used to increase the concentrations and half-lives of L-Dopa and dopamine in the brain of a patient receiving L-Dopa therapy?
3. Compare the differences between acute dystonias and tardive dyskinesia; include in your answer the symptoms and time for symptom development and resolution, and the treatment options available.
4. Contrast the mechanism of action of Subutramine and Orlistat in the Management of Obesity
5. Answer the following two questions about the selective COX-2 inhibitors.
  - a) Why were the selective COX-2 inhibitors developed?
  - b) Why has the use of rofecoxib been ceased? Outline the probable mechanism of its major adverse reaction.
6. Explain why a patient who has experienced a cough while taking an angiotensin converting enzyme (ACE) inhibitor is able to take an angiotensin II receptor antagonist without experiencing the same problem
7. What is a 3D pharmacophore? What three structural relationships are generally included in such a model?
8. Describe the steps used to build a homology or comparative model.
9. Discuss, with named drug examples, the mechanisms by which anticancer drugs kill tumour cells.
10. Discuss, with named drug examples, the mechanisms by which antimicrobial agents kill bacteria or inhibit their growth.
11. Seizure classification can be broken down into two broad categories:
  - i. **Define the difference between partial onset and generalized seizures.**
  - ii. **Describe two specific mechanisms by which current anti-epileptic drugs (AEDs) act to reduce seizures in epilepsy patients**
12. List the five (5) main classes of antidepressant medication and briefly describe the mechanism of action of 3 of the 5 classes